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Devoted to Commercial and Naval Motor Craft

OCTOBER, 1918
Vol. 3. No. 10

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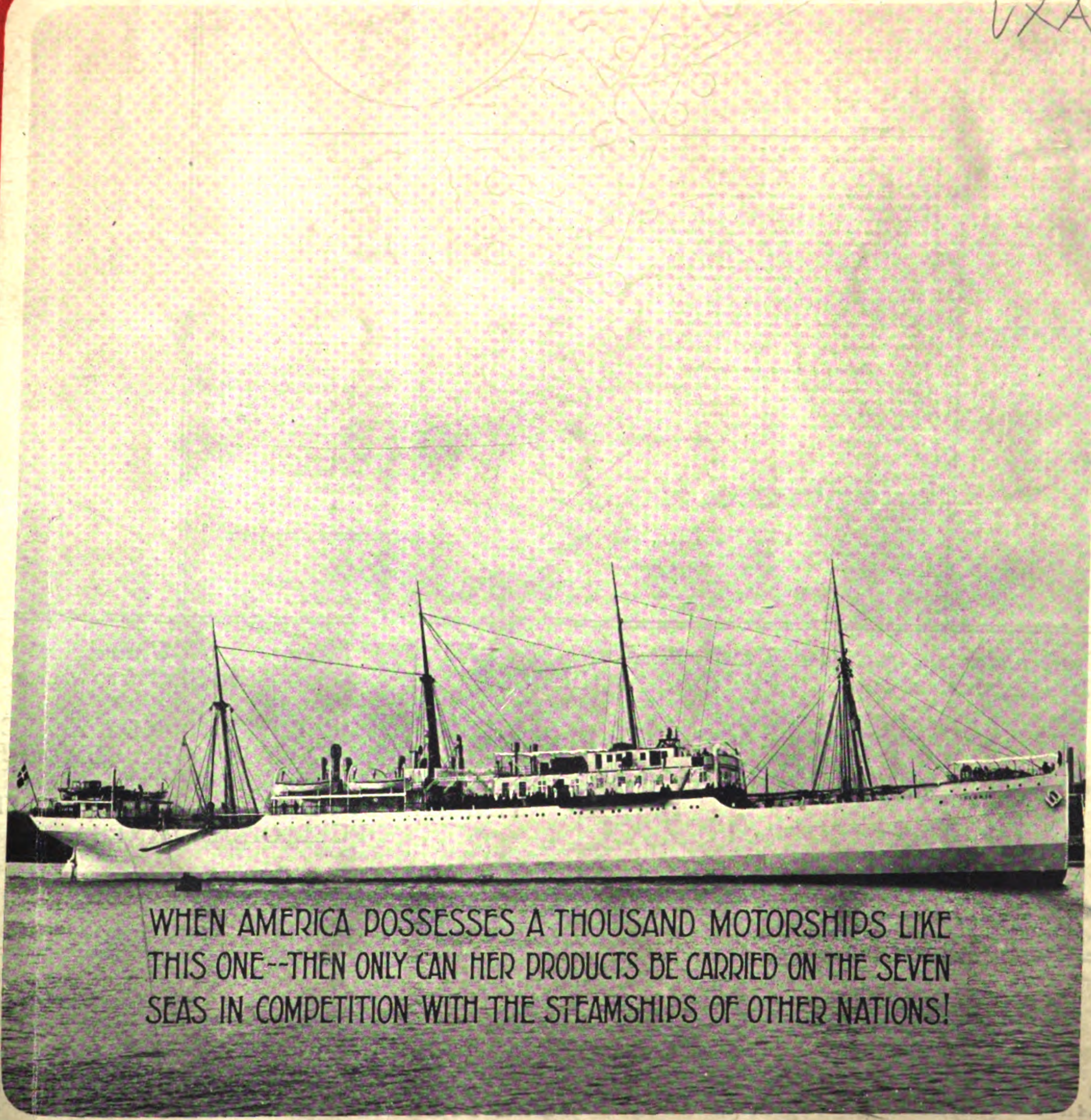

MOTORSHIP

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PUBLISHED MONTHLY IN THE INTERESTS OF COMMERCIAL AND NAVAL MOTOR VESSELS AND FOR RECORDING PROGRESS OF THE MARINE INTERNAL-COMBUSTION-ENGINE

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October, 1918 Vol. 3 No. 10

LEADING EDITORIAL CONTENTS

PRINCIPAL ILLUSTRATIONS

The oil-engined motorship has arrived! It is such a pronounced economy that it was bound to come. Nothing could stop it! And all obstacles have been removed as fast as they arose. The law of progress has seen to that. Very strong prejudices stood in the way of steam. But, one after another they were swept aside and steam reigned triumphant for a century. Steam now has had its day! Its zenith has passed, and gradually but surely it is being superseded by the economical internal-combustion power. America, the most important oil-producing country, is to be the greatest motorship-owning nation. Let us all co-operate and assist to make that day soon

EDITORIAL

POST-WAR MARINE COMMERCE

In a recent admirable statement, Mr. Edward N. Hurley, Chairman of the U. S. Shipping Board, outlined with clearness the future shipping policy of the Government in respect to post-war trade and the reasons for building America's huge merchant fleet. Mr. Hurley, who has a trend of thought somewhat above the average in plane, frankly emphasized that these merchant vessels will not be used after cessation of hostilities for making a trade-war against our gallant Allies whom we now are assisting with all our might, main, men and money.

Such sentiment of course is splendid and no doubt we all wish our merchants, traders and shipowners will live up to it. In the same way America would not have been in this real war had Germany listened and lived up to the standard of the noble ideals outlined by our own President Wilson several years ago.

Fair competition—even if strenuous—produces business that otherwise would not exist, and without foreign business many nations would go bankrupt. Obviously then, after the war all countries will strive for "supremacy" in international trade. Consequently, although it will not be started by the United States (provided fine men like Wilson and Hurley are in authority) after peace has been declared and affairs become settled, there is bound to be such a tremendous competition among all countries for the carrying of freight on the high-seas that the resultant friendly business rivalry virtually will form something approaching a trade war, once the amount of goods to be carried is less than the capacity of ships in service. Even among the American coastwise trade alone the most economically operated and best managed ships, such as motorships, will seriously be felt by domestic shipowners who own steamers and sailing-vessels, especially if the termination of war happens to leave us with more steam-ships than we have products to carry several years afterwards.

Also to endeavor to make America entirely self-contained and to export only and not import would be courting disaster, apart from making it impossible to operate our steamships in foreign waters, and the international money-exchanges would suffer so much that our manufacturers and traders would be unable to do any business. Incidentally it will be a hard task for America to make a post-war trade campaign with her new coal-fired and oil-fired steamships, because they will have to be used on the same routes as the economical and cheaply-operated foreign motorships now being built by all other nations—including Germany.

The very future and prosperous existence of many countries will rest with their success in securing extensive international trade, and, unless a nation's ships can carry produce as cheaply as those of other countries, she cannot be prosperous continually. That is why America previously has been a third-rate maritime commercial power. Her laws made it impossible for her ships to operate sufficiently economically to compete with the merchant vessels of other countries and she had no motorships. Had America previously been a great and successful ship-owning country, some of the terrible financial and bad business years probably would not have occurred. With ships, ships, and ships rests both the immediate and future well-being of all nations—particularly America; but, other countries can build and operate their ships at lower cost than America can, so it is essential that America's ships be economical motorships.

Undoubtedly other nations, when they are free to do so, will make hitherto unknown strenuous efforts to carry the products of the markets of the world. Particularly Germany, whose merchant shipping now is in a state of chaos. Already the Reichstag has passed the bill for the restoration of the German merchant marine, and grants will be made after the war to Teuton shipping companies of about five hundred million dollars ($500,000,000) in the form of subsidies. It seems that this money will be given, or loaned without interest, and the grants will continue for nine years after declaration of peace. During the first four years the subsidies may be from 50% to 70% of the total cost of the ships. No wonder Germany is building a huge motorship yard. *(Continued on next page.)*

Sir Joseph Maclay, the British Comptroller of Shipping, recently stated that the transport service maintained by Great Britain only had been accomplished by the sacrifice of important trade interests, which would have to be recovered as soon as the emergency has become less acute. Now, if other nations' ships by that time are serving such routes, how can Great Britain secure back the trade without severe competition and without using her merchant ships for such purposes? So it is not surprising that Great Britain also will build motorships and that, as detailed elsewhere in this issue, one great British Diesel motorshipyard now being erected will have sixteen slipways.

On the other hand, it appears to be Italy's intention to increase the quality of her ships rather than the quantity. And, as Sig. Ugo Ancona recently pointed out, it is with fine ships that Italy will be able to enter into competition even with England and America. Consequently we can understand why Italy is building standardized Diesel-driven motorships, which vessels she terms her "Emergency Fleet."

Obviously America must have "quality," too, and it becomes more and more apparent that it is vitally important to order additional motorships as rapidly as slipways become vacant, for, in the economical Diesel-driven motorships we have the most suitable war-time merchant vessel, also the only type of cargo-carrier for post-war trade.

Although Diesel engines at present are a little more costly than steam-engines and boilers, a big steel motorship can be built cheaper than a steamer per ton of cargo capacity, because a motorship of 10,000 tons displacement will carry overseas about 1,000 tons more actual cargo in her holds than will a steamer of the same dimensions and with the same amount of structural steel in her hull.

The same motorship will require less men to run her (although carrying 10% more cargo) because of the absence of stokers. Her fuel bill at sea will be reduced to between one-third and one-fifth and her port stand-by charges will be reduced 90%, also she will not be dependent upon foreign fuel-stations for her return bunkering. Furthermore, when Diesel engines are built in larger quantities the cost will be less than steam machinery because the oil-motor lends itself so excellently to standardization.

Thus there is every reason why we should build hundreds of motorships as quickly as is feasible—but no more steamships except big liners, and there is no sound reason why motorships should not be built now. Only two arguments yet have been offered against motorships and the same are excuses rather than reasons. One is that the marine Diesel engine is not reliable and the second is that there are insufficient trained engineers to operate such vessels. The first, of course, is totally incorrect, as the Diesel engine when properly designed, constructed, installed and operated gives far less trouble than the average marine boiler. Even supposing it was not reliable, then its merits and advantages are so remarkable that the nation's best engineers should at once set-to and make it reliable. As regards operating-engineers, these can be trained in the shops and on training ships while the engines are being built What other countries can do, America can do. So let us do!

BIG GERMAN MOTORSHIP BUILDING YARD

Supported by the Most Powerful Business Interests in Germany

SOMETIME ago "Motorship" referred to the new great German merchant motorship building yard that was being erected near Hamburg. At this yard nothing but standardized Diesel-driven motorships of 10,000 tons d.w.c. (tankers and cargo carriers) will be built, and the city of Hamburg has granted a 75-year lease of the land at Finkenwarder, where eight slipways are being laid out.

At the back of this motor shipyard are Albert Ballin (President), Hugo Stinnes, and William A. Riedemann, with whom are co-operating the Allgemeine Elektricitats Gesellschaft (A.E.G.), and the Gutehoffnungshutte—an important steel and ore concern at Oberhausen.

The directors of the new company are Albert Ballin (Hamburg American Line), president; Felix Deutsch (A.E.G.); Paul Rensch (Gutehoffnungshutte); Paul Jordan (A.E.G.); Otto Harms (Deutsche-Australische Linie); Oscar Overweg (Kosmos Line); Theodor Amsinck (Hamburg-South Amerika Linie); W. Fehling (Deutsche Ost Afrika Linie).

Although Germany is our enemy, no one would assume otherwise than the above-mentioned financiers are clever, shrewd, and far-sighted business men; and, that they realize the importance of the large Diesel-driven motorship should not be disregarded without the deepest thought by those in charge of America's merchant marine, for after the war our steamships will have to be operated in competition against these German motorships, which may be subsidized to about 70% of their cost by the German Government. At present the capital of this new concern will be kept down to $2,380,000.00. Just before America entered the war, one of the directors of the Kosmos Line called at our office and advised us that he was making an extensive study of motorships on behalf of his company, who intended placing in service a large number of motorships and motor auxiliaries as soon as peace was declared. The result of his investigation is obvious!

THE ENGINEER QUESTION

TURBINE-DRIVEN steamships," says the U. S. Shipping Board in a memo released on September 14th, "must have specially trained engineers, as the latest development in the geared-turbine for driving ships is a complicated and highly delicate piece of mechanism, so the Shipping Board has sent picked men to the builders' works with instructions that the men 'grow up with their engines,' and the same idea of special instructions is applied in the case of water tube boilers."

We are glad to see this official announcement that the Diesel-type engine is not the only marine propelling mechanism that requires specially trained engineers, so that the engineer question no longer is a bar to the adoption of this class of economical machinery. (The Diesel motor uses less than one-third the amount of oil-fuel consumed by the geared-turbine). Also we are pleased to note that the Shipping Board now is planning to instruct Diesel engineers, but regret the same has not passed the stage of preliminary discussion.

DAWN OF A NEW ERA IN THE TRAWLING INDUSTRY

PARTICULAR interest will be evinced in the new oil-engined trawler described and illustrated in this issue as the success of this pioneer vessel marks a new epoch in the fishing industry. The U. S. Shipping Board Emergency Fleet Corporation has just ordered a large number of trawlers in which steam machinery exclusively will be fitted, so we only can conclude that a study of the working of this new motor-trawler cannot have been made by the Corporation. The oil-engine is particularly adaptable for fishing-vessels of all types, and in Great Britain the Government's Fishing Boards for years have been doing everything possible to encourage the adoption of the oil-engine in such vessels and have made large loans and grants for the purpose. It would not be amiss for this country to do likewise at this time when sea food is of the greatest importance. Economical motor fishing craft will assist to make the price of fish low.

AUXILIARY MOTORS IN SAILING SHIPS

ABOUT a year has passed since "Motorship" first drew attention to the urgent need for Federal action in seeing that auxiliary-motor propelling-power be installed in all suitable sailing-ships. Also it is about a year since the Government of Italy advised her shipowners that unless suitable oil-engines were installed in Italian sailing-ships, such vessels would be requisitioned for a period of twelve months. The question of auxiliary motor-power was very thoroughly discussed in the last issue of "Motorship," so its advantages need not be reiterated here. There are in service of the American merchant-marine hundreds of cargo-carrying ships that rely entirely upon the vagaries of wind and tide (or tug boats) for propulsion; and, for shipowners to maintain that their efficiency and cargo-carrying ability cannot greatly be increased by auxiliary motor-power, shows either strong prejudice or absence of common sense. Arguments that marine internal-combustion engines are unreliable may be passed over with the remark that during the four years of this war the British Government have purchased from one motor engineering firm alone between 200 and 300 marine heavy oil motors (over 50,000 B.H.P.), which have given excellent service in various types of craft. Also that oil-engined motorcraft are the mainstay of the transportation of the vast quantities of munitions from England to the seat of war. All these things being so, let us not delay any longer, but proceed with the installation of auxiliary motor propelling-power in all strongly constructed sailing-ships. Plenty of oil-engines are available, and it is an urgent war necessity!

VAL FISHER'S MESSAGE TO AMERICAN BUSINESS MEN

APROPOS of our editorial leader entitled, "**Vital Need of Publicity and Preparation for After-War Trade,**" in our last issue, a strong message on similar lines by Val Fisher was published in the New York daily papers on September 5th, and all American business men should read the same. Here are a few of the pointers made by Mr. Fisher:

"This is a time when every manufacturer, every business man, should look far ahead. Good-will cannot be built in a day, even by advertising. The war will not last always. We have all seen the mistake of being unprepared for war; it is almost as great and serious a mistake to be unprepared for peace."

(*Continued on Page* 19.)

Some Important Comments on the Design of Marine Diesel Engines

With Particular Reference to Experiences Gained in Developing the Normand Mercantile and Naval Heavy-Oil Motors

By F. FENAUX, DIRECTOR, CHANTIERS ET ATELIERS AUGUSTIN NORMAND

[EDITORIAL FOREWORD—With France in the throes of the most terrific and terrible fighting ever known, one does not hear much about French marine Diesel engine development, and, as far as we can trace, "Motorship" is the only publication that has given any information of work accomplished in this direction during the war. From the Chantiers et Ateliers Augustin Normand of Havre, who perhaps are best known for their world-wide adopted marine steam boilers, we have received this most interesting communication which details their views regarding the features of design of marine Diesel-type oil-engines with particular bearing on their own engine. It would be well for the development of the domestic heavy-oil engine industry if American manufacturers discussed their opinions on designs as frankly as Augustin Normand do. There is no Society devoted to this branch of engineering, but "Motorship" acts as an excellent clearing-house and distributory, and at all times its columns are open for interesting, technical discussions of general value. Such will greatly assist the development and adoption of the marine internal-combustion engine. Augustin Normand have had particular success with such fuels as earth-nut and other vegetable oils, coal-tar oil, and mineral oils. The following article—specially written for "Motorship" by the Managing Director—has been translated from the French with great care, but it is possible that a few errors have occurred.—THE EDITOR.]

During the War, we had to adhere to our known types of marine Diesel oil engines in connection with which, we only made an improvement in the use of same for submarines. We can, however, give some additional details with regard to our four-cycle merchant-marine type engines of 500 effective horse-power (b.h.p.) at 200 r.p.m., and we will outline our ideas with regard to several questions referring to the Diesel motors in general.

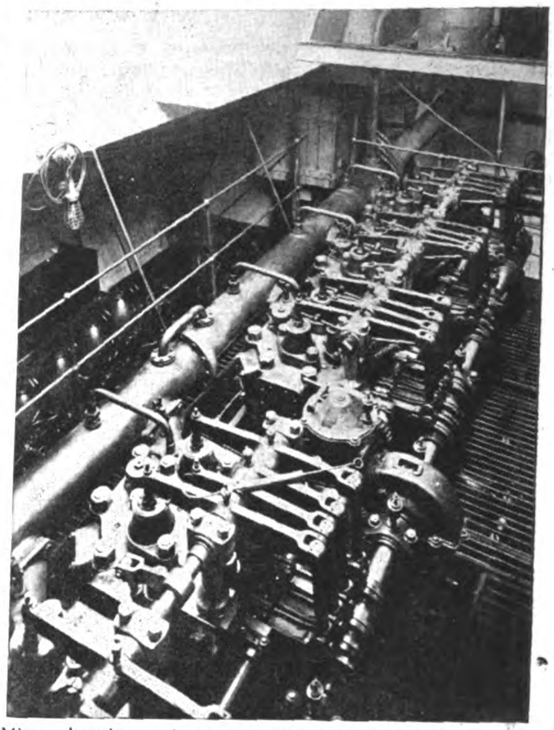
In "Motorship" of May, 1917, you published a short article on this engine. There was a difference between the weight that had been allowed to us in the estimate, and the real or actual construction weight of this motor. Last year we advised you that the weight of this 500 b.h.p. engine was 150 kilos per b.h.p. However, it actually weighs hardly 100 kilos, including fly-wheel, piping and compressed-air tanks per b.h.p.

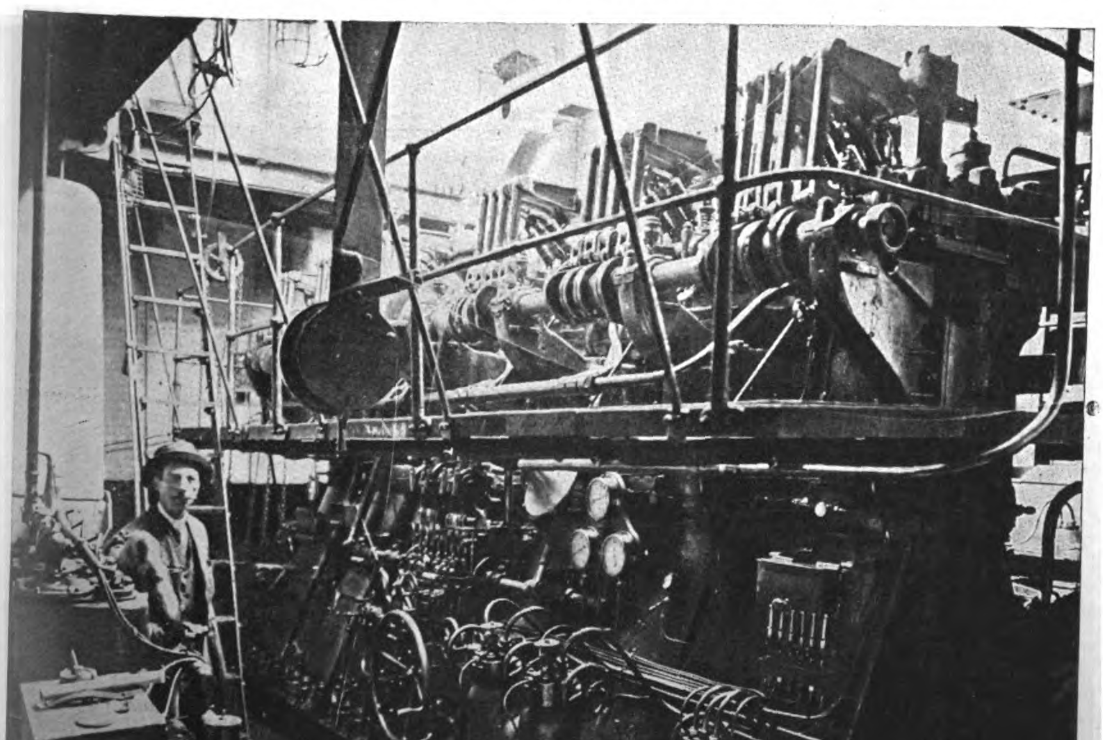
Many designers consider that a slow-speed marine-engine, even if it is not of great power, must be of the so-called cross-head type, on account of the facility of taking apart, on account of the visibility and accessibility during operation, and in order to touch or lubricate the joints of the small end of the connecting-rod; also on account of the lower temperature at which the shoes can operate on the shoe-guides.

We are not of the same opinion. For a power or capacity up to about 800 h.p. splendid operation can be obtained with double-wall (trunk) pistons, and much less vibration, owing to the reduction of the parts having a reciprocating movement. The mechanical efficiency is practically the same, but the height of the engine is greatly diminished. The rubbing surface, cast-iron on cast-iron, gives excellent results, provided the piston is long enough not only to increase the surface, but also to lower the sliding surface in relation to the part destined to insure the tightness. In this manner the frictions occur between walls which are cooler, and where the lubrication easily can be attended to. We wish to add that, owing to the rapidity with which one can take off the head and remove the piston in the Normand type of engine, the inspection of the small head of the connecting-rod, is easily effected. The experience, in all cases, has been entirely favorable for this kind of an arrangement on our engines that are in service, and has been possible to obtain more than 20 consecutive hours of operation at 200 revolutions, whereas the tests only call for 6 hours.

A third point which we want to elucidate is the following: The uniform feeding of the fuel-oil to all the cylinders, the requirement of proper maintenance of the parts, and high efficiency are certainly more staple with the system using only one pump, that feeding several cylinders via distributing needle-valves, than the system of small separate pumps for each cylinder. We know that the contrary system is in general favor for such reasons as the fear of an excess of fuel-oil fed to any one cylinder, or the difficulty of regulating the numerous needle valves, the adjustment of any of which could reflect (react) on all the others. Nevertheless, experience has induced us to abandon the small separate pumps in favor of two large pumps, each one feeding half of one distributing chamber that is provided with two three-needle groups for regulating the flow or the forcing of the oil to the six cylinders. Each pump, therefore, feeds three cylinders. In this way individual regulation is greatly facilitated.

If desired, the operator can easily communicate the two compartments of the distributing chamber, and feed all six cylinders, by means of a single pump, even in any degree of power, in case it is desired to inspect the valve flaps of the other pump during the operation. In this way, one can very quickly obtain the individual regulation, even with six needle valves. The collective regulation of the group of cylinders of the left, in relation with the group of cylinders of the right, can be done also during operations by acting throughout the length of the adjustable connecting-rod, controlling the suction flap of each pump.


View showing valve arrangement of Normand marine Diesel engine


Engine-room of a French motor gunboat fitted with a 500 b.h.p. Normand Diesel engine

In order to avoid examining the adjusting parts during each operation, provision has been made for an indicator for the opening of the needle-valves, which is formed by a small graduated toothed-wheel, slidable on a quick-acting screw (with large pitch) in such a manner that the opening can be easily read in revolutions and 1/100s of revolutions, which can be recorded for future reference. Furthermore, between each packing joint and the chamber, there is inserted a diaphragm (screen) in which a hole is drilled, the diameter of which has been experimentally determined for the operation at any degree of power. In this way, the most important condition, i.e., the equalization of load for the maximum efficiency is complied with, upon the opening of the needle-valves, and these latter only provide for any such slight differences which may arise at low speeds.

We have proven by real diagrams before an official Commission that without any modification of the opening of the needle valves (all opened by one turn) and by means of the use of diaphragm (screens), corresponding to the perfect equivalence of the diaphragm at 200 revolutions, we could reduce the number of revolutions to 175, then to 150, then to 120, then to 100, and then to 84 per minute, not only without any lack of combustion at each cylinder, but with very slight differences in the distribution of power between the cylinders.

We do not fear any accidental excess of fuel-oil at one cylinder on account of a faulty manipulation at start, generally at the time of the fitting of the piping (closing of the other needle valves) for the engineer-in-charge is immediately aware of this by the safety-valve which gives its alarm at 42 kilos, and corrects this fault.

On the contrary, with a system of separate small pumps, when the volumetric output of a pump is bad, there is increased the time during which the suction-flap falls back to its seat; in case it happens that during operation the tightness of the flaps is endangered by a scratch produced by dirt, and which must be immediately re-established by the hammering of the contact surfaces, this pump renders unnoticably more fuel-oil when compared with the other pumps, and this only can be observed if one is very careful, by opening the individual discharge cocks, or by touching the cylinder cooling-water discharging pipes. Furthermore, one runs the risk at full power, of a gripping or at least of a fouling of one of the cylinders.

With regard to the advantages of these engines, when compared with the two-stroke cycle Diesel engine, we still feel sure that the four-cycle engine is superior, except perhaps in a case of very powerful submarine engines. The consumption of fuel-oil is also very much less, as also the consumption of lubricating oil. Certainly the engine has larger or more numerous cylinders, but it does not require scavenging-pumps. Furthermore, these cylinders heat much less at the same pressure, and one does not need to be afraid of internal or external cracks at the end of a certain time of operation, as they are often produced on cylinders of two-cycle engines, the cast-iron of which is not absolutely perfect, and with regard to which the individual power, on account of differences in the volumetric output of the fuel-oil pumps, has been excessive during a certain time without this having been observed.

The average working-pressure of a four-cycle Diesel engine can surpass 5 kilos per square centimeter, a figure which corresponds approximately to 6.6 kilos, average pressure indicated, whereas on the majority of two-cycle engines, these average pressures, respectively amount to only 3.5 kilos and 6 kilos approximately, without any possibility of an occasional over-load. With regard to the speed of the piston, this can be, perhaps, increased in the case of the four-cycle engine. On the one hand, from the point of view of a good combustion, the discharge of the burnt gases, and the inlet of clear air can be effected in sufficient time. On the other hand, as far as the balancing is concerned, no scavenging-pumps are required that give rise to vibrations at high-speeds. Furthermore, the bearings figured for the same occasional over-load have a lesser attendency to become heated, because they are subjected to have the work only.

The economy of weight obtained by the use of a two-cycle engine is really very small and sometimes is non-existant.

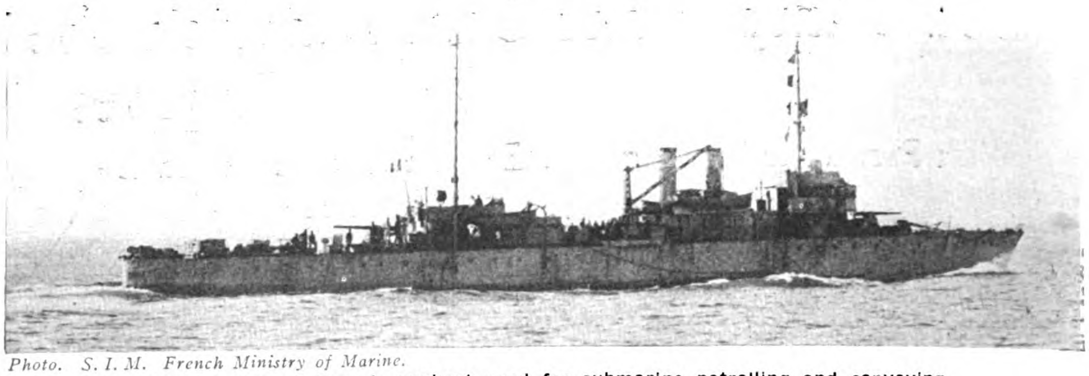


Photo. S. I. M. French Ministry of Marine.

Special type of French gunboat used for submarine patrolling and convoying

CONTENTS OF THIS ISSUE

This issue of "Motorship" is specially interesting by reason of the detailed opinions of various prominent American and European builders of marine oil-engines regarding features of design and construction, much of which is of a controversial nature, and the two-cycle versus four-cycle question receives not a little attention. The views of other designers and builders are invited for publication in subsequent issues.

TARAKEN CRUDE-OIL FUEL

In Taraken a very valuable oil-well has been struck, which gave an initial production of 1,200 tons (336,000 gallons) per day. Taraken crude-oil, while very heavy, has been used as fuel with considerable success by Diesel-driven motorships.

General Notes and News

SOME CARGO SHIP!

The new ship "Naldera," recently launched at Greenock-on-the-Clyde, carries 14,000 d.w. of meat cargo and has a speed of nineteen (19) knots. She originally was intended to be a fast liner, but 600,000 cubic feet of her holds have been insulated.

EXPERT BRITISH OPINION

"Arms and the Man," one of the leading British military critics, writes: "I hope your campaign for the Diesel-propelled freighters and destroyers will prosper even more than it has. It is the bottle-neck of the whole situation. I look on "Motorship" as one of the most valuable of contributions to war journalism."

SHORTAGE OF SHIP'S STOKERS

According to a notification received from the U. S. Shipping Board (August 25th) there is a very serious shortage of firemen for the merchantmen and a drive for firemen is being made. Here exists another reason for building motorships, because the latter require no stokers, and at the best of times these men are very difficult to handle and frequently delay ships in harbor, often making the situation more difficult to handle than the motorship engineer question.

ROYAL DUTCH PETROLEUM AND THE BRITISH GOVERNMENT

During the last eighteen months we frequently have referred to the enterprising operations of the Royal Dutch Petroleum Company, who have foreseen the coming of the great merchant motorship marine, and have, through its subsidiary companies, opened up sea-port fuel-stations all over the world in addition to placing in service themselves a large number of big steel motorships and motor-auxiliary sailing-ships. Consequently our readers will be interested to learn that all Royal Dutch shares held by the British public have been purchased by the British Government. The British Government also recently purchased the controlling interest in the Anglo-Persian Oil Company, which is a subsidiary of the Royal Dutch Co. In North and South America these interests are represented by the Shell Company of California, the Roxana Petroleum Company of New York, the General Asphalt Company of Philadelphia, and the Venezuelan Oil Concessions. The overseas oil-fuel stations for motorships are handled by the Asiatic Petroleum Company of London.

The Roxana Company has arranged for the United States Government to utilize the new pipe line between Cushing and St. Louis, and, as this pipe line soon will have a capacity of 960,000 gallons per day, it is proving of great value to the Government because it is fast taking the place of the tank steamers between New Orleans and New York, allowing these badly-needed vessels to be used for other purposes.

One of the British subsidiary companies has one hundred million dollars ($100,000,000.00) in War Loans and Treasury Bills, and part of this money is to be utilized in establishing additional oil-fuel stations all over the world. This will be of the greatest importance to motorship owners. The Chairman of this company is urging the British Government to stop constructing steamers and to build only standardized motorships.

"THE KEEL"

A most attractive home-journal termed "The Keel" has been issued by the Todd Shipyard Corporation of New York, and we have a copy before us. We congratulate the editor of "The Keel." One section contains quite a lot of useful knowledge pertaining to things maritime.

AUSTRALIA DESIRES ENGINE AGENCY

Mr. L. Littlechild, of the Champion Cycle and Motor Depot, Hobart, Tasmania, is desirous of obtaining an agency for a good crude-oil engine made in sizes from 5 h.p. to 50 h.p. Engine builders interested in the foreign market please communicate with Mr. Littlechild.

THE "JUNO" NOW AN AMERICAN-OPERATED SHIP

Among the Dutch vessels recently seized by the United States Government is the Werkspoor-Diesel-driven motor tanker, "Juno," owned by the Netherlands-Indies Tank Steamboat Company and operated by the Anglo-Saxon Petroleum Company of London. As both of these companies are subsidiaries of the Royal Dutch Petroleum Company, and as all the stock of the latter company owned by the British public has been purchased by the British Government, it will be interesting to know the present status of this motor vessel.

DR. LUCKE'S ARTICLE

"The Engineer," of London, for July 26th, devotes a lengthy editorial leader to a review of Dr. Lucke's article (which appeared in the June, July and August issues of "Motorship"), and term him a recognized authority both in Europe and America, and commend the vigorous originality of thought expressed, and find his discourse stimulating for the reason that Dr. Lucke flies in the face of accepted tenets of internal-combustion engineering. They say: "Professor Lucke endeavors to awaken us from this commercial lethargy. He believes that the big oil engine has still a future before it, and his endeavor to show how that future may be attained is laudable in every respect. It will be said by those who read his paper that it is somewhat vague, somewhat halting, somewhat uncertain. So it is, but we could expect nothing else. Had all been perfectly clear, then it would have been achieved years ago. Professor Lucke seeks to lead us into a nebulous region, but a region of great possibilities. He desires to get us out of the rut into which the commercial exploitation of the oil engine has drawn us. If he does nothing more than arouse some discontent with the present position, if he stirs engineers to think of new improvements, if he leads them to experiment in fresh experiments, even though they prove abortive, he will have done internal combustion engineering an invaluable service."

ITALY AND THE MOTORSHIP QUESTION

In April last this journal published exclusive details and illustrations of Italy's Emergency Steel Motor-ship Fleet, now building at the yards of Ansaldo & Co., Ansaldo-San Giorgio and the Savoia Co. These are Diesel-driven vessels of 8,000 and 10,000 tons d.w.c. each. Recently Commendatore Perrone, chairman of the board of directors of the Ansaldo Company, said: "The Ansaldo Society merely is waiting for the completion of two yards to begin the construction of wooden ships with auxiliary oil engines. There is no doubt that the Diesel motor will be of valuable assistance in this connection, and will help in the developments of Italian shipping along the national coasts and those on the Mediterranean."

Commendatore Perrone recommends for ocean navigation sailing-ships, with auxiliary engines, of 2,000 tons, and for the Mediterranean coasting trade smaller vessels without sails, driven by one or two heavy-oil motors. On the other hand, for the coastwise trade Signor Calamai prefers sailing-ships of not more than 600 tons, but provided with an auxiliary oil engine. As to the construction of ferro-concrete ships, Signor Calamai says: "There are many supporters of the concrete ship in Italy, the principal of whom is General Guiseppe Rota, of the engineering branch of the Italian Navy.

GERMAN NAVAL MOTORBOAT ATTACK

German motor torpedo-craft made a sortie near Dunkirk on the night of August 23rd. According to British reports, the Allied forces suffered no casualties, but it is believed that one German motorboat was destroyed. On the other hand, the German Admiralty claims that three Allied torpedo-boats were hit by torpedoes from their motorcraft, and that two were sunk; also that the German craft returned without loss. Obviously one of the reports is grossly inaccurate, so the British and French admiralties would do well to publish a detailed story of this engagement and so squash the Hun lies.

Scandinavian Motorship Building Notes

FOURTEEN LARGE STEEL MOTORSHIPS ON ORDER IN NORWAY OF 7000 TO 10,000 TONS D.W.C. EACH

It is well-known that several Norwegian shipowners have ordered a number of motorships from the Burmeister & Wain yards at Copenhagen, Denmark. Besides the "George Washington," 10,000 tons, delivered last year, Fred Olsen & Co. have just recently received her sister ship, the "Bonheur." The keel of a third ship is laid, but this will probably not be ready to launch for some time yet.

Of other ships building there are six to be delivered to Wilh. Wilhelmsen, Tonsberg, Norway, each of 10,000 tons approximately. Thor Thoresen is going to have a ship of 9000 tons, The Nordenfjeldske Steamship Co., two ships each of about 8000 tons, and the Bergenske Steamship Co., two motorships of about 7000 to 9000 tons.

ANOTHER NORWEGIAN CONCRETE MOTORSHIP

The concrete motorship "ODDFRID," a vessel of 1000 ton d.w. was recently launched at the Fougner's Steel-Concrete Shipbuilding Company, at Moss, Norway. The vessel has been constructed for transatlantic service. The concrete motorship "Stier," was illustrated and described in the August issue of "Motorship."

NORWEGIAN SULZER-DIESEL COMPANY

A Sulzer marine Diesel engine license has been acquired by the Norsk Maskinindustri Aktieselskab, Thunes Mek. Vaersted of Christiania, Norway, and this firm will build two-cycle type marine Diesel engines of from 150 to 2,000 b.h.p. They are one of the largest and most important shipbuilders in Norway.

MOTORSHIP FOR ROMSDAL COMPANY

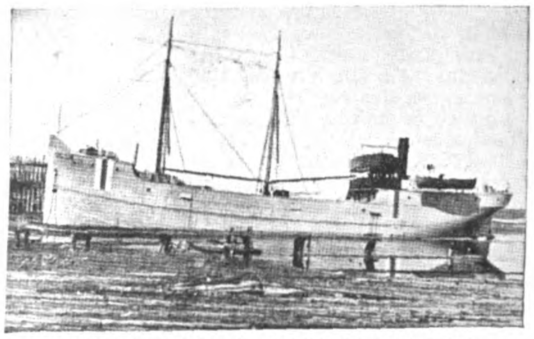
The Bolsonaes Shipyard and Mechanical Works in Norway has been awarded a contract to construct for the Romsdal's Shipping Co., a motorvessel of 550-600 tons d.w. to be ready for delivery in 1909, and it will be equipped with a 260 B.H.P., crude-oil engine.

EIGHT NEW SURFACE-IGNITION ENGINED NORWEGIAN MOTORSHIPS AT ONE YARD

There has been launched by the Ved Vikkilens, Skibsbyggeri A/S of Grinistad, the 300-ton motor auxiliary schooner "Celtic I" to the order of Harris Hanssen of Sandefjord. The vessel is fitted with two Skandia surface-ignition oil-engines of 55 b.h.p. A sister ship, the "Celtic II," will be afloat by the time this appears in print. Six other motorships (two of 300 tons and four of 600 tons) are on order at this yard.

King, and the family originally came from Sweden. We presume that the turbulent state of Russia has caused the founding of this new Swedish company.

The motorvessel "Fenja," a three-masted auxiliary of 400 tons d.w.c., has been built for Hojer &

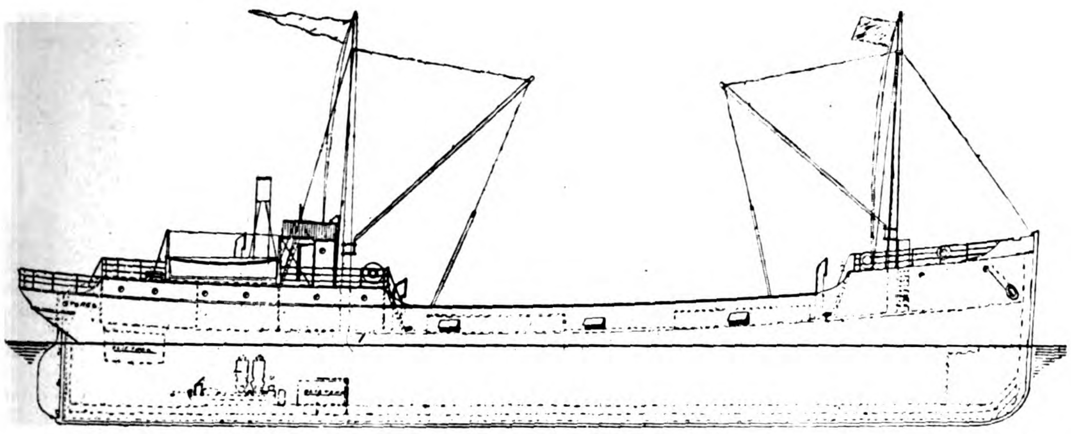


The new Swedish motorship "Calcium."

Svenssen of Stockholm. She is 114 ft. long and is fitted with an 80 h.p. Bolinder oil-engine. She is classed by the German Lloyds.

A new standardized steel motorship has been launched from the Fra Norrkopings Varr Mekaniska Verkstad from designs by Hugo Tollens. The "Calcium," as this ship is named, is a full-powered twin-screw freighter with auxiliary sails, and is driven by 270 b.h.p. Avance surface-ignition oil-engines and there also is a three-ton electric which for handling the cargo. Her length is 150 ft. by 28 ft. breadth and 12.3 ft. depth. She was built for the Rederiaktiebolaget Nordtransport of Stockholm, Sweden, who we understand are planning motorships of 3,000 and 5,000 tons capacity. We illustrate the "Calcium" on this page.

The composite motorship "Tebe I," classed by the Bureau Veritas, has been launched by the Ved Satva Varv. She is about 188 ft. long by 24 ft. breadth and 10 ft. depth, and is of 600 tons capacity.



A new 700-ton Norwegian motorship fitted with a Danish "Diesel" engine of the solid-injection type.

NORWEGIAN STANDARDIZED "DIESEL"-DRIVEN WOODEN MOTORSHIPS

Another Instance Where Solid-Ignition Is Employed

There are under construction at the Stavanger Dock and Shipyard four twin-screw full-powered "Diesel"-driven wooden motorships to the order of the "Lloyd I" Shipowning Company. These vessels are specially interesting by reason of their being equipped with high-compression heavy-oil engines that use solid-injection of fuel, instead of air-injection as is more commonly employed. Furthermore, the general construction follows in design the average surface-ignition hot-bulb engine, inasmuch as an enclosed crank-case of similar shape has been adopted. Probably the builders here utilized the patterns of the bed-plate and crank-case of their own surface-ignition for these "Diesel" models.

The dimensions of these four motorships are as follows:

Dead-weight capacity	700 tons
Length	167′ 0″
Breadth	29′ 2″
Molded depth	13′ 9″
Power	320 shaft h.p.

The two Hera propelling oil-engines are of 160 b.h.p. and are of the two-cycle high-compression type and except that no compressed air is used for the injection of fuel, they operate on the Diesel principle. They are four-cylinder models, so are non-reversible, and for reversing of the propellers a mechanical clutch and gearing is employed. The working pistons of the engine compress air for scavenging in the crank-case as is customary with the majority of surface-ignition engines. Separate force-feed lubricators are attached to each cylinder and a feed run to each main bearing. The engines were built in Denmark by the Hera Motorfabrik of Copenhagen. The general arrangement drawing of the ship, illustrated on this page, shows a two-cylinder engine, but this was afterwards changed to four-cylinder engines.

MANY MOTORSHIPS BUILDING IN SWEDEN

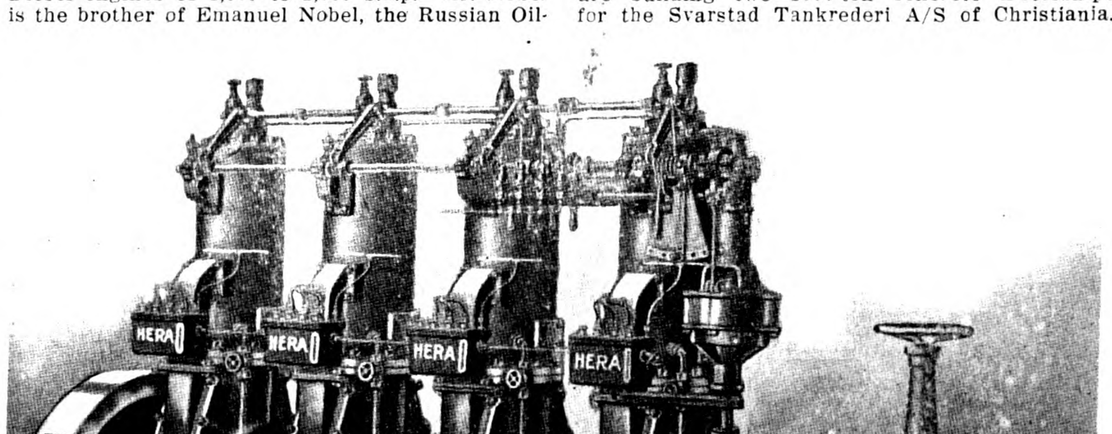
Considerable progress under the difficult circumstances is being made by motorships, which rapidly are leaping into favor of Swedish steamship owners. A big Swedish company has been formed by Ludwig Nobel of Petrograd, Russia, to build the Nobel marine Diesel-engine, and the new concern has a capital of seven-and-a-half million Kroners ($2,250,000). This well-known engineer and financier has built and installed over two hundred large passenger, freight, tank, towing, and naval ships and submarines with crude-oil motors. Most of the merchant motorvessels are from 1,000 to 6,000 tons d.w.c., while many of the naval craft have Diesel engines of 1,000 to 2,000 b.h.p. Mr. Nobel is the brother of Emanuel Nobel, the Russian Oil-

SURFACE-IGNITION HEAVY-OIL ENGINES IN DANISH AUXILIARIES

Among recent installations of Bolinder engines in Danish ships are: Several developing 160 B.H.P. for 350-ton ferro-concrete ships; four of 120 B.H.P. for vessels being built at the Kallundborg yard, which is associated with a Marienborg shipowning firm, and was begun during the war; two engines of 160 B.H.P. for a 500-ton ship and a 320-ton schooner, respectively; and two similar engines for a barque of 2,000 tons d.w. capacity. This is a total of eleven motors aggregating 1,600 B.H.P.

FOUR NEW 100-TON NORWEGIAN CONCRETE MOTORSHIPS

A 1,000-ton concrete motorship is building for Hans Kiaer & Co., shipowners, Drammen, Norway, which is a duplicate of the motorship built for them last May at the Jernsbetonskibsbyggeriet, of Greaaker, Norway and referred to in a previous issue. In both vessels two 160 b.h.p. Bolinder heavy-oil-engines are installed. At this yard also are building two 1000-ton concrete motorships for the Svarstad Tankrederi A/S of Christiania.



One of the Hera solid-injection "Diesel" engines installed in a Norwegian motorship

New Era in the American Fishing Industry

A 300 B. H. P. Oil-Engined Atlantic Coast Trawler

By GEO. S. HUDSON

CONTRASTING with many of the older power fishing vessels on the East coast, fuel-oil propelling motors and a complete electrical installation are striking features of the 140-foot trawler, "Pioneer"—an innovation in the fishing industry of the North Atlantic that ought to bring a smile of satisfaction across Mr. Hoover's pleasant features. And the best of it all is that the "Pioneer" is making good, and other ships of her type are to follow.

The F. C. Pearce Co., of Gloucester, Mass., own the unusual vessel which was designed to cut the cost of operation and maintenance as found in steam trawlers, of which two score are in commission and hailing from New England. Already the "Pioneer," which made her maiden trip to Cape Sable, N. S., last August, demonstrates that she can be run at about one-half the cost of steam and very much cheaper than by gasoline.

To begin with, the new vessel is the embodiment of ideas that crystalized through many years before men dared to face so costly an experiment. The "Pioneer" bears marked resemblance to a steamer with conventional funnel, pilot house and lofty forecastle head. But she has no coal bunkers; therefore hold space is considerably greater than in the ordinary steam-propelled trawler. She can carry 400,000 pounds of fish, and, more than that, the electrical equipment lends such flexibility to gear that steam is discounted even beyond roseate expectations. And flexibility, when towing a beam trawl at end of a 400-fathom cable, with mouth of the net 200 feet wide, is of supreme importance, particularly should the trawl foul a submerged wreck or pinnacle reef. At all hazards the net and cable must be kept away from the propellers, otherwise there might be a salvage bill to settle.

So Archie Fenton, naval architect, of Gloucester, was summoned in consultation as to the best lines for a fast and burdensome hull, and the Gray-Aldrich Co., of Boston, recommended the propelling outfit and electrical apparatus. Tarr & James, of Essex, Mass., famed as birthplace of three-quarters of the schooners engaged in the New England fishery, were awarded the construction contract. Veteran shipbuilders, a few more than 80 years old and with a lifetime at the trade, shook heads when they learned the beam was but 22 feet on draft of 13 feet; these knights of the adz and auger having been accustomed to a greater proportion of width to length. Notwithstanding the prophecy that the vessel would be an ungodly roller, the designer refused to add a foot or two to beam that might reduce speed.

Slowly this departure trawler took its place among the Smiths and Joneses of the fishing world. Construction was seriously delayed by slow delivery of material, a complaint heard at every yard. There was no positive assurance that the Government would not commandeer the craft for naval purposes. Thus the "Pioneer" grew through a period of uncertainty as to what might happen next. In due time, however, the hull was put overboard and towed to Gloucester for finishing touches.

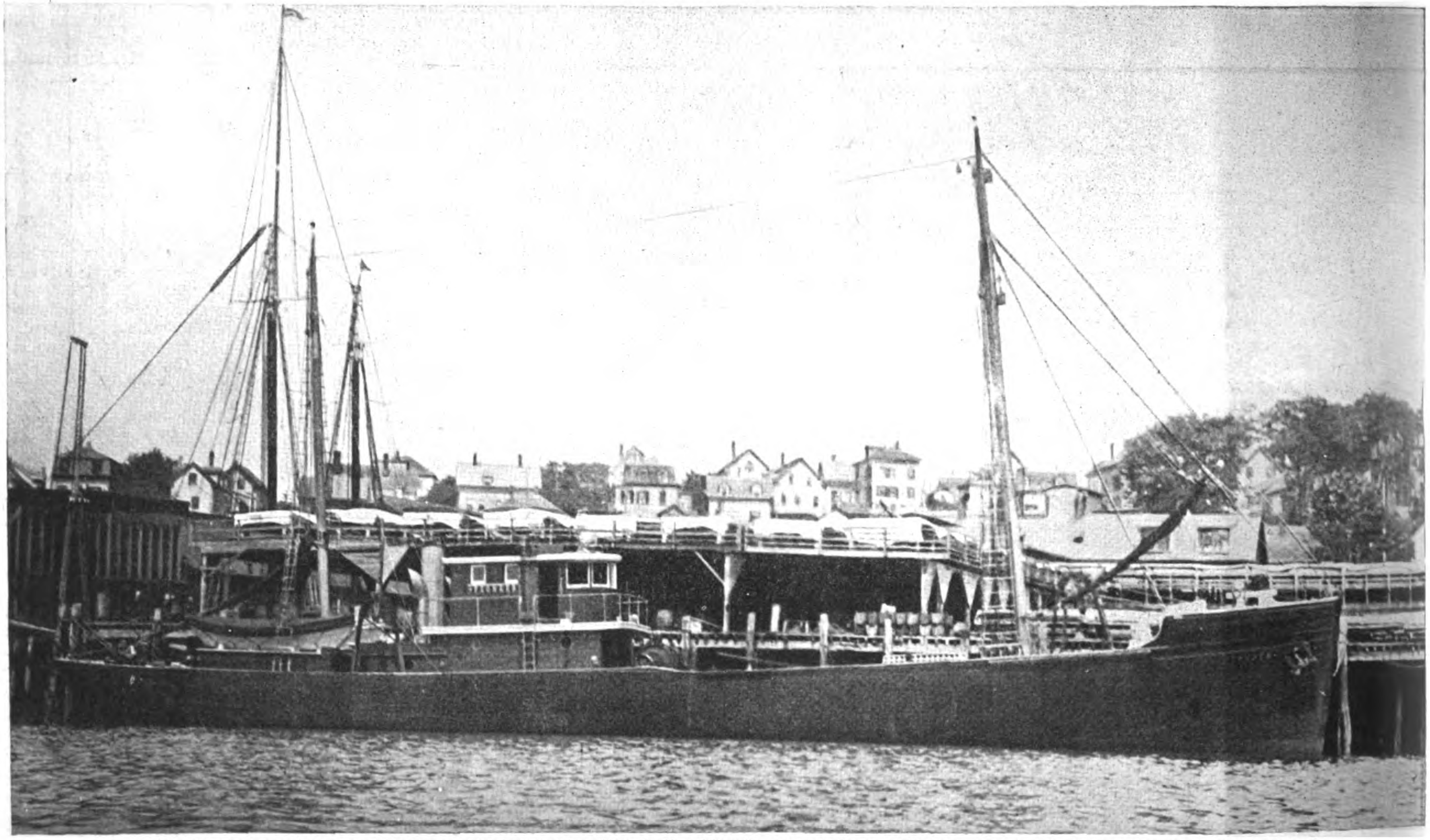
At this stage the engine-room structure was incomplete, being represented by a rectangular opening in the deck with 30-inch combings dovetailed at corners and drift bolted to beams through a massive sill of oak. This construction follows closely the regulation "fisherman's house," except that the planking of sides and deck is 2⅞ stock—white pine, of course—and the 1-inch bolts are forelocked to interpose strength against battering seas. After the motors had been lowered into place the structure was decked. A huge skylight and side companions leading to a grating over the iron ladder facilitates access to the motor alleys or to the battery of tanks installed in what, ordinarily, would be the lazarette. These tanks, five to a side, with 4-foot alley, have combined capacity of 10,000 gallons, being connected by twos. There are two settling or reservoir tanks and the usual strainers, provision being made to draw from one tank of the series, or from all.

The Fairbanks-Morse motors are of the two-cycle surface-ignition type and, on the block, delivered about 75 h.p. above their rating. Ignition for starting only is by means of a coil of wire contained in a device resembling and about the size of a spark-plug. Current from a storage battery almost instantly heats this wire to a red heat, igniting the charge of oil vapor sprayed into the combustion chamber by pumps working at pressure. Heat from subsequent explosions maintains the plug at incandescent heat, and electricity is no longer required while the motor is in operation. Starting is by means of compressed air, and the motors are direct-reversible, the operator throwing a lever to "stop" while going ahead and into "astern" for the reverse—quite similar to steam-engine practice.

A 100 h.p. Fairbanks-Morse type fuel-oil motor is connected to a generator, and, in turn, discharges into an electric motor, this latter motor (also Fairbanks-Morse) being set athwartships, but the compartment is so roomy that the installation of three motors of such large proportions does not give one the impression of over-crowding. The entire width of the hull is represented in the compartment, permitting thorough inspection of moving parts from stuffing-box to the fore end of the crankshaft. Each propelling motor compresses air for starting, and, in addition, a small motor under the forecastle head delivers an auxiliary supply. Four flasks, one strapped to each corner of the motor compartment, hold air at 200 pounds pressure. The main motors have three cylinders 14x18 inches, and each engine normally delivers 150 B.H.P.

The propeller shafts, of steel, are 6 inches in diameter and about 23 feet in length. Each propeller, a Hyde pattern of iron, is 68"x48", the direction of rotation being outboard. Stern bearings and struts are of manganese bronze specially designed. Area of the propellers is relatively large to exert the strong pull so essential in towing a heavy trawl, and the wheels are protected by a lattice device against fouling. Ordinarily, while a net is out, a steamer the dimensions of the "Pioneer" proceeds not faster than three or four miles an hour. The "Pioneer," by virtue of twin screws, may be swung in not much more than her length, a consideration lacking in single-screw vessels.

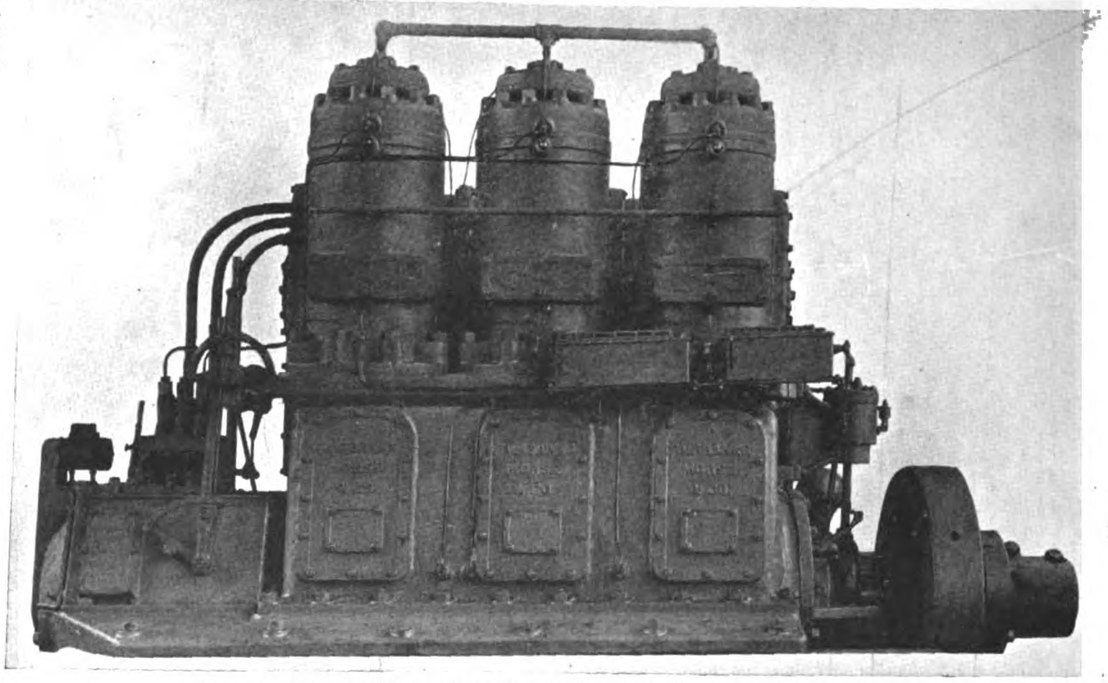
Special mention should be made of the manner in which the "Pioneer's" exhaust gases are disposed of by means of an exhaust pot at the base of the funnel, the pipes being so arranged as to discharge into a pool of water regulated by an overflow. A tendency to splash is controlled by deflecting or plates encircling the pot's upper rim. The exhaust pipes are made up with a specially-



This vessel may mean a revolution in trawler construction in the Atlantic coast fishing industry. She is the new motor trawler "Pioneer"

designed flange riveted to the funnel and bolted to a flange bearing an ell on the funnel's inner circumference, the 8-inch pipes of the main motors and the 6-inch pipe of the generator motor entering at different heights.

When this net is coming aboard the electric winch has a pull of 15 tons. The current is generated by an oil-engine driven generator



Two of these 150 b.h.p. Fairbanks-Morse oil-engines propel the "Pioneer"

A net load of fish being dumped into the pens that prevent shifting of the deck cargo of the "Pioneer"

With this device in operation puffs of steam are emitted from the funnel, much after fashion of a high-pressure tug and noise of explosions is by no means annoying. This muffling equipment was designed by the Gray, Aldrich Co., who also made drawings for the castings, as well as furnished much of the machinery and fixtures in connection with the deck layout.

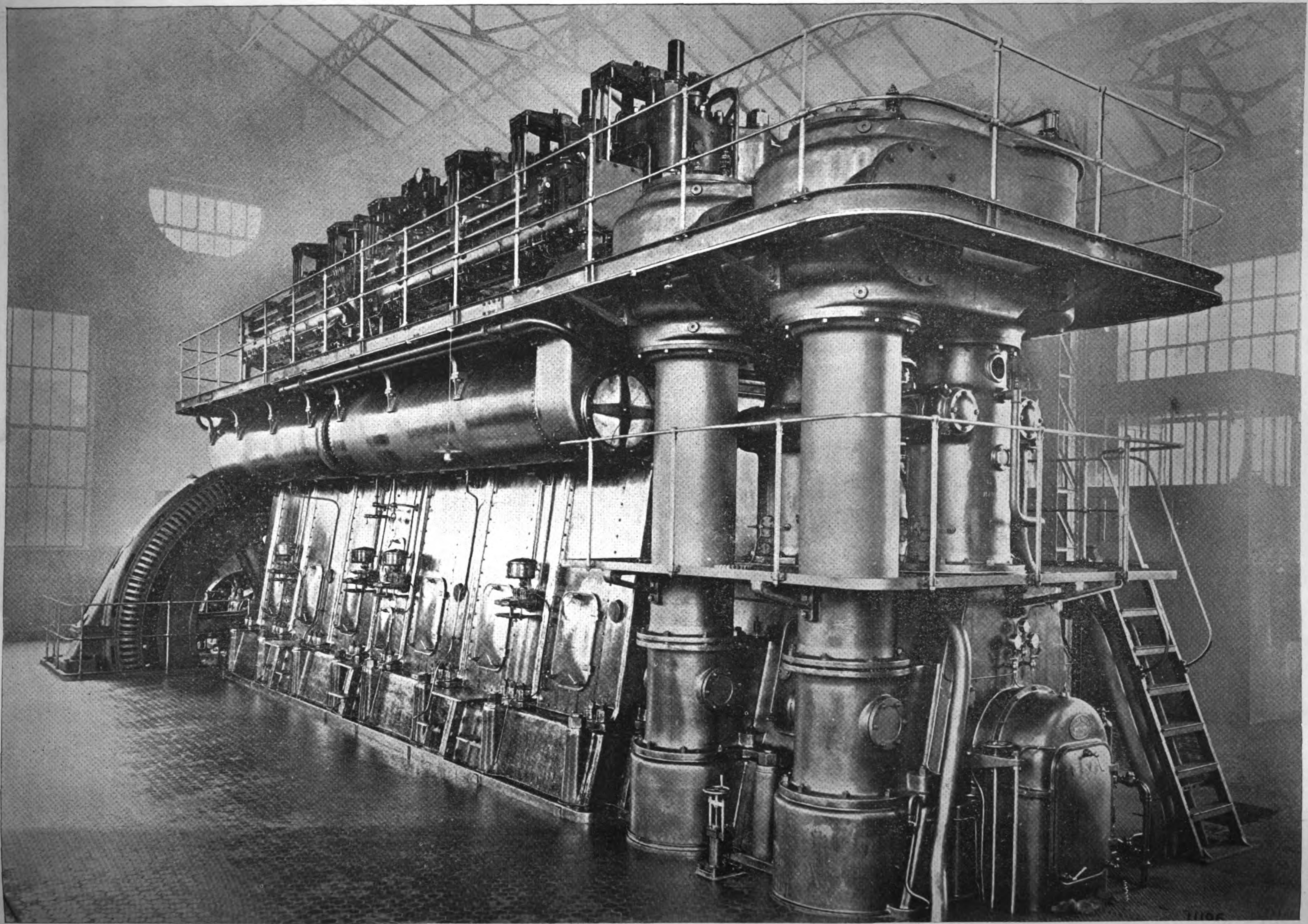
When the big motors were being given a trial at the pier the "Pioneer" easily pulled the wharf structure four inches out of plumb after parting several good hawsers. Thereupon the vessel was warped end for end, and without much ado pulled the wharf back into line again. The trial was in charge of C. W. E. Witter, of the Fairbanks-Morse Boston office. Actual work of installation was in charge of Paul Fritsch, assisted by David Harrigan and Augustus Dunsky, the latter going as chief engineer with Harrigan as assistant. Chief Dunsky has had years of experience, recently in such high-powered auxiliaries as the "Georgia" and the "Elk."

Under the forecastle head, in addition to the air-compressing motor already referred to, is a 10 h.p. Fairbanks-Morse motor, geared to a winch handling cargo and stores. Another motor operates a pump of moderate capacity for use in case of fire, for slushing or freeing the bilge. By means of messengers and snatch blocks aided by a turn round the nigger heads of the winch, this motor does the work of several men. Water tanks of 2,500 gallons capacity are located under the floor of the forecastle. The ballast, 30 tons of boiler punchings, iron pigs and cement, give a smooth floor to the hold with its 14 fish pens.

Electricity for power is generated by the direct-current 75 k.w. 250v General Electric generator belted to the 100 h.p. motor above referred to, the current being wired to the power switchboard on which is mounted current indicator, a main switch, ground detector and circuit-breaker which protects the generator in event of overload. The power board feeds through a street-car type controller to a 65 h.p. series motor equipped with electric brakes. The motor is geared to a specially-designed deck winch which operates the trawl. Lighting current is obtained from a 6 k.w. 115v. direct-current generator coupled to the 10 h.p. Fairbanks motor. This generator is used for charging the 120 amp. hour storage battery, as well as for lighting, the battery suplying current when the generator is idle.

In all, about 30 lights for general illumination, as well as the running lights, are included in the equipment. A large battleship-type searchlight and a floodlight to facilitate handling trawl and stowing cargo, are mounted on the pilot house. All wiring is done in conduit and in accordance with the National Electric Code. The equipment was completed in four weeks' time by Wallace Martin, expert on motors and controllers; Edward Pollinger, expert on switchboard construction and distribution, and Everett Pollinger. Installation was engineered by Donald Corckburn. Later, the vessel will be equipped with wireless, the better to keep in touch with the market while fishing 400 to 600 miles at sea. Capt. Fred Thompson, whose exploits in the auxiliary schooner, "Gov. Foss," would make excellent reading, commands the "Pioneer."

Deck of the motor trawler "Pioneer" from the pilot house, showing bollards and gallows for working the trawl



This 4,000 b.h.p. Sulzer Diesel engine smashes the fallacy that oil-motors cannot be installed in large liners or 20,000-ton freighters. Three engines similar to this one would give a continuous output equivalent of 13,500 steam i.h.p. (14,850 maximum i.h.p.), so would propel a very large twin-screw ship if made reversible, and its speed reduced. It is part of an electric power-plant in France, and is similar to the one at dry-dock at Belfast, illustrated in our September, 1917, issue. It has six cylinders 760 mm. bore (29.92") by 960 mm. stroke (37.79"), and turns at 135 to 140 r.p.m.

Progress Made With The Sulzer Two-Cycle Diesel Engine During Recent Years

By H. SAMUEL KILCHENMANN

[Every designer of Diesel-type marine engines has his own reasons and theories for following certain lines of design and construction, so the opinions of this well-known European engineer doubtless will be of the greatest interest to our readers, but we do not necessarily endorse any or all of the opinions expressed.—Editor.]

AN European engineer, in coming to America, is sure to be struck by the great development made in certain branches of engineering in this country. The writer, who has devoted much of his time and thought to the development of the internal-combustion engine, has been greatly impressed by the tremendous progress made in the design and manufacturing methods, particularly of the light gasoline and heavy gas engines.

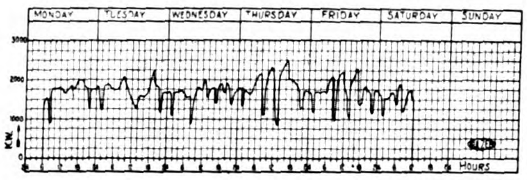
Fully recognizing this, it is hard for the foreign engineer to understand and realize that the Diesel engine, known for its high economy, and which has even greater posibilities than the gas or gasoline engines, has not taken the place that it should in this country of almost unlimited resources. This is particularly striking when we remember that America has such an abundant supply of fuel-oil. The probable reason this engine has not been in more general use here can perhaps only be explained in that there is such a large supply of coal and other fuels in this country, which fuels can be obtained at a relatively cheap price. Therefore, an engine of high fuel-economy is not so vitally essential as in countries where the quantities of fuel are very restricted. In many countries fuel is very scarce, and the supply of fuel-oil is very limited and the oil being mostly of a poor quality. For these countries, therefore, it has been of paramount importance to develop a prime mover of the highest possible heat economy. The invention and development of the Diesel engine has resulted in a big strive in this direction.

The superiority of this engine was soon recognized, owing to its high efficiency and its adaptability to general power requirements. The demand for engines for stationary power plants of larger and larger sizes developed rapidly. At the same time it was also recognized by engineers that this engine possessed great possibilities for ship propulsion.

The first Diesel engines were built according to the well known four-cycle principle. However, it was soon apparent that the demand for units of large power outputs could not be met by engines built to this type, owing to the limited capacity of the individual cylinders, and the impracticability of increasing the number of cylinders to provide for the market requirements. The problems thus presented to the engineers were very complex, but promised great possibilities.

Considering the working principle of the Diesel engine, it will be seen that the work which the power piston accomplishes during the suction and

WEEKLY LOAD CHART
OF A SULZER TWO CYCLE DIESEL ENGINE OF 4000 BHP AT 132 RPM



exhaust strokes can be performed by an air-pump especially adapted to this service, which furnishes air for scavenging purposes and the air charge for the power cylinders. A power stroke per cylinder per revolution is thus obtained, that is, the engine works on the two-cycle principle; and for a cylinder of given dimensions, the power output is nearly doubled.

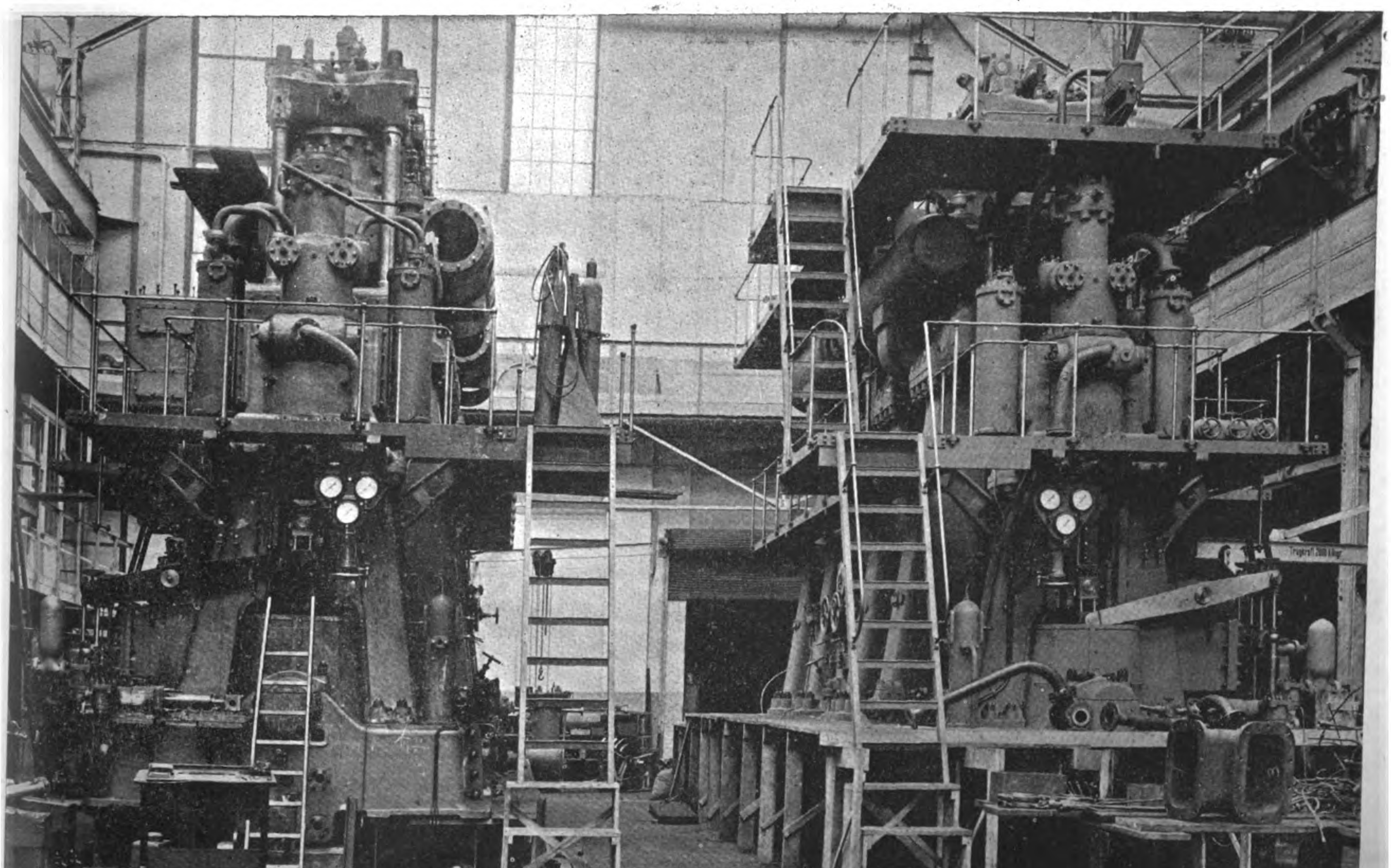
The well known engineering works of Sulzer Freres, Winterthur, Switzerland, being one of the pioneers in the development of the Diesel engine, were the first to realize these advantages and build two-cycle engines. The first two-cycle, reversible Diesel marine engine was built by Sulzer Freres in 1904, and was exhibited at the Exhibition at Milan in Italy in 1905. Since then, Sulzer Freres have worked untiringly on the development of large two-cycle Diesel engines.

The first two-cycle engine was simply designed according to the four-cycle engine; i. e., the scavenging air was introduced into the cylinders through valves located in the cylinder head. These engines gave remarkably good results, and were built in units up to 2000 B.H.P. in four cylinders. It was found from the very outset, that owing to the absence of exhaust-valves, low grade fuel-oils with high content of asphaltum and sulphur could be used.

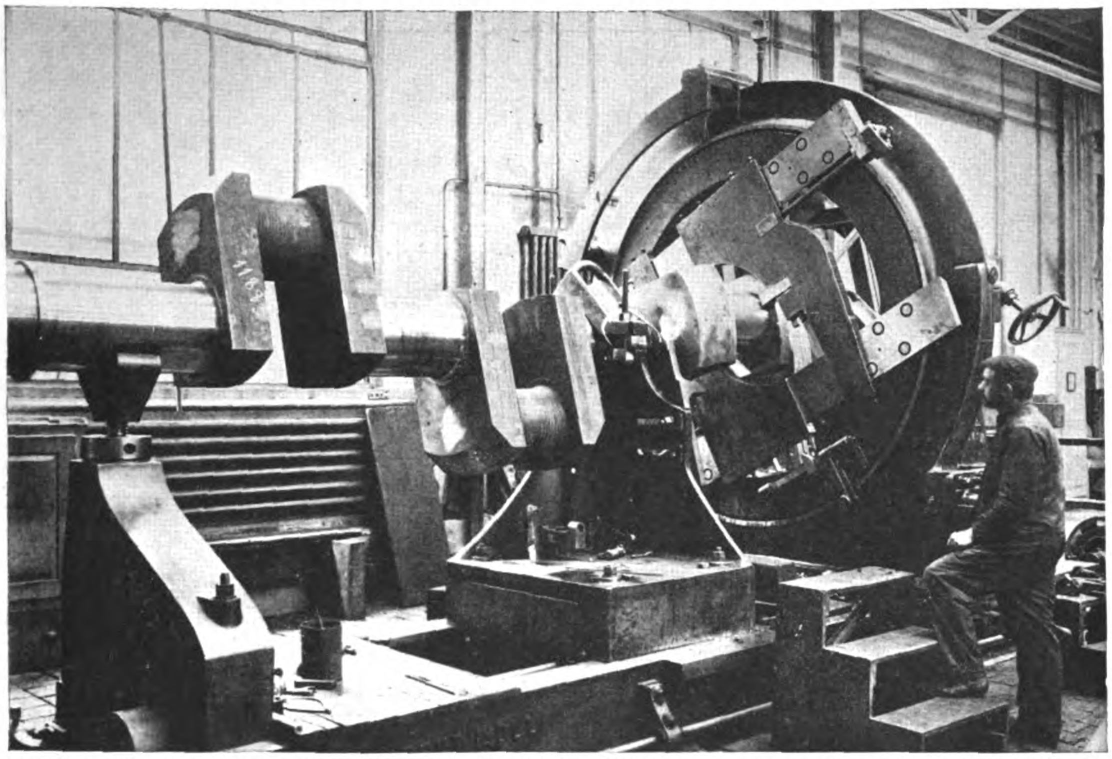
There were, however, certain points which were not entirely satisfactory. For instance, introducing the scavenging-air through valves in the head proved to be faulty as air vortices in the cylinder took place, rendering a good scavenging impossible. Therefore, burnt gases remained in the new air charge, contaminating same, thereby preventing perfect combustion and thus causing high working temperatures. Furthermore, the cylinder head with several large openings for the valves is a weak element of construction which had to be eliminated.

All of these unsatisfactory points, however, being in no way defects of the two-cycle principle itself, Sulzer Freres set the best engineering talent to work on the solution of the problem, and after considerable research and experimentation, evolved and developed their present type of engine which works on the two-cycle principle, the main features of which are briefly described as follows:

The scavenging is an improved cylinder port-scavenging, there being two rows of scavenging-air ports in the cylinder wall opposite to the exhaust ports. The piston, on the down stroke,



Two 1600 b.h.p. (equivalent to 3500 steam i.h.p. combined) Sulzer direct-reversible marine Diesel engines now installed in one of the numerous British Admiralty motor tank-ships



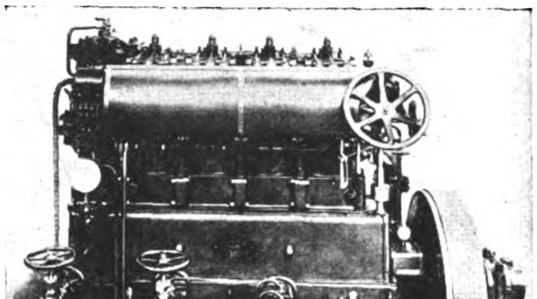
Special machine-tool at the Sulzer Bros. works for turning Diesel-engine crankshafts. The crankshaft is held rigid and the tool rotates around it

uncovers the upper row of scavenging-air ports first, but as the connection with the scavenging-air receiver is closed by a valve, or slide, the exhaust-gases cannot enter the scavenging-air receiver The piston next uncovers the exhaust-ports and the exhaust-gases escape and expand to atmospheric pressure. The piston then uncovers the lower row of scavenging-air ports, and the scavenging begins; about the same time the valves open and allow scavenging also through the upper row. The combined action of the two separate air streams insures a complete expulsion of all burnt gases. On the up stroke, the piston first covers the lower row of scavenging air ports, but scavenging still continues through the upper row of ports. The piston next covers the exhaust ports, and the air entering the upper row of scavenging air ports can no longer escape; thus a charge of fresh air of more than atmospheric pressure is delivered to the cylinder, which means increased power output.

The following are what I consider to be the advantages of the Sulzer type two-cycle engines:

(A) In the combustion chamber, which is subject to high temperatures, fuel and starting valves only are located, whereas the ports for the air inlet and exhaust are in the lower part of the cylinder where the temperatures are low.

(B) The combustion chamber is of the ideal double convex form, in which perfect combustion



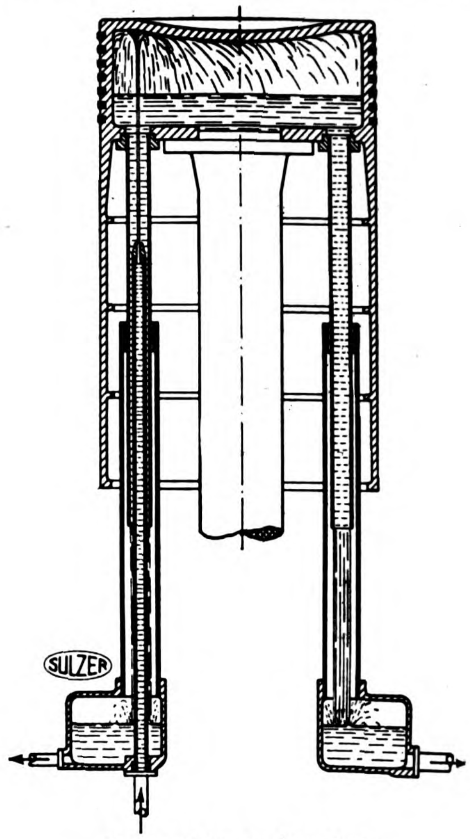
The first direct-reversible marine Diesel-engine. It was built by Sulzer Bros. and exhibited at the Milan exposition in 1905. It develops 100 b.h.p. at 450 r.p.m.

is insured. This, in connection with the total absence of exhaust valves, is of greatest importance, as the engine thus can burn cheap, low grade California and Mexico fuel oils with high content of asphaltum and sulphur, as well as tar oils of poor quality.

(C) The very restricted number of moving parts, and the total absence of large valves in the combustion chamber, make the engine especially fit for long non-stop runs.

(D) All castings subjected to high temperatures and stress are symmetrical and of simplest possible form.

These advantages, I maintain, are demonstrated by hundreds of engines of this type, which are in service since several years past. Whereas, four-

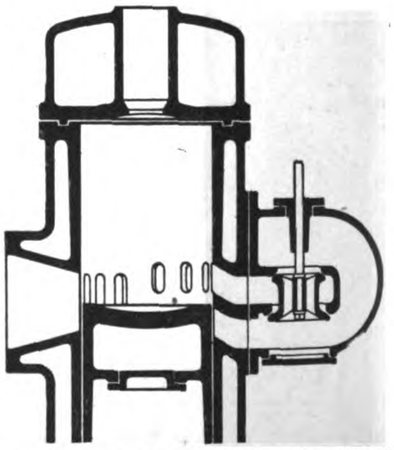


Sulzer piston-cooling device

cycle engines of different makes do not differ materially one from another, there are two distinctly different types of two-cycle engines which differ in the essential point, i. e., the way of scavenging, viz.:

The old type two-cycle Diesel engine, with the scavenging through valves in the cylinder head, and the new Sulzer type two-cycle Diesel engine, with the scavenging through two rows of ports, the upper row of ports being controlled by a valve.

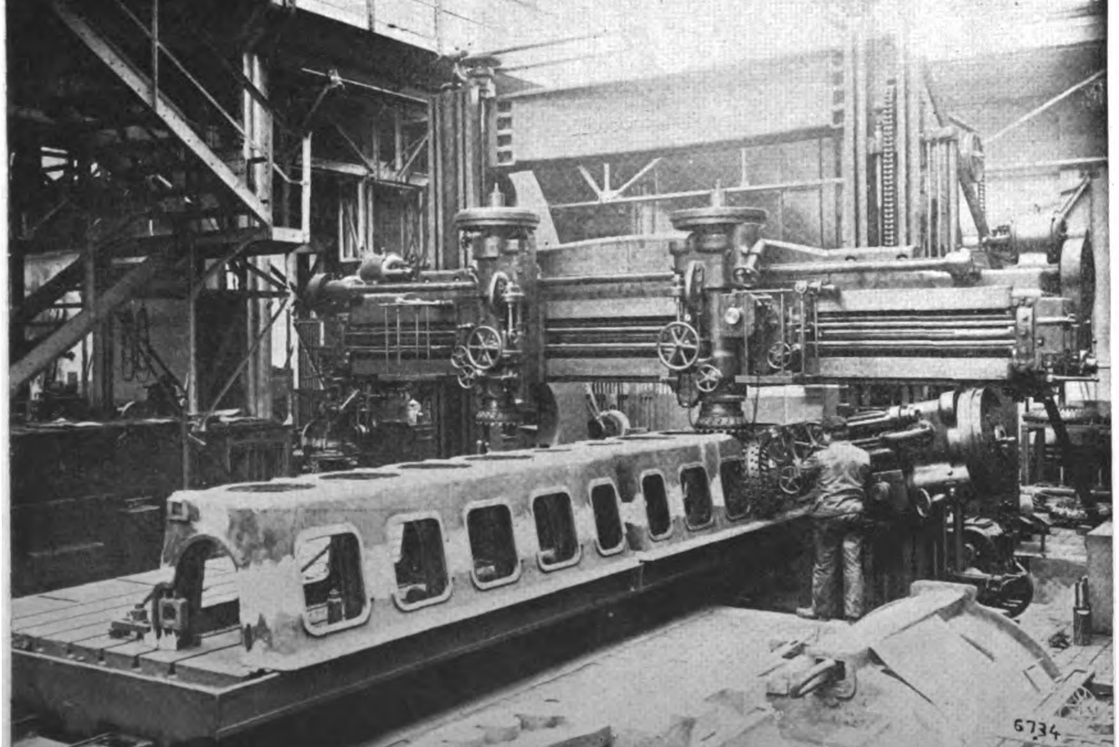
The old type, valve-in-head scavenging engines, which was formerly a generally accepted construction of the two-cycle Diesel engine, and is still so made by some engine builders, has provoked considerable prejudice against the large Diesel engine, and the two-cycle engine especially. When comparing the various types of engines, it should always clearly be stated what system of scavenging is used.



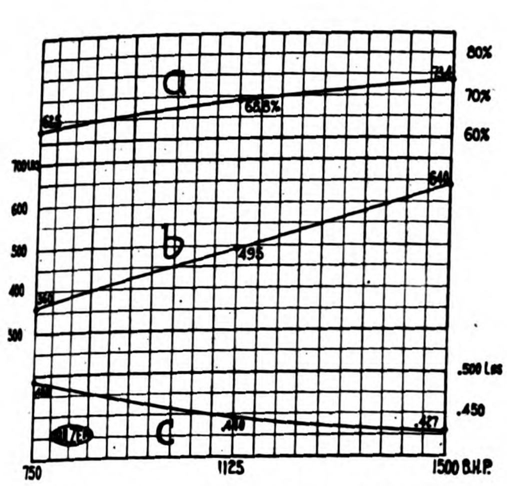
The standard Sulzer cylinder head and port scavenging system

The principles of the new Sulzer-type engine, above described, adapt themselves equally well to light, high-speed engines for special purposes, and to heavy-duty type engines for stationary and ship propulsion.

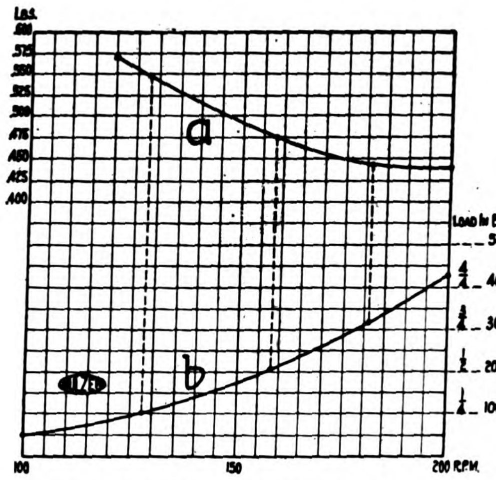
In fact, Sulzer Freres have built Diesel engines of this type in sizes with bores of the cylinders ranging from 10 inches to 40 inches in diameter, and have obtained equally good results from all sizes. From this it will readily be seen that the principle is applicable to engines of a wide power range, and engines of the largest power output are of essentially the same design as the smaller



Machining the crankcase of a large Sulzer high-speed marine Diesel-engine on a big milling-machine



TEST RESULTS OF A SULZER TWO-CYCLE DIESEL ENGINE OF 1500 B.H.P. AT 150 R.P.M.
a = MECHANICAL EFFICIENCY
b = FUEL CONSUMPTION PER HOUR
c = FUEL CONSUMPTION PER B.H.P. HOUR.



FUEL CONSUMPTION CURVE BASED ON POWER ABSORBED BY PROPELLOR AT VARIOUS SPEEDS. - 420 B.H.P. ENGINE
a = FUEL CONSUMPTION PER B.H.P. HOUR.
b = POWER ABSORBED BY PROPELLOR.

units; thus for large units the complication of the double acting type is avoided. [Test results of a one-cylinder engine of an output of 2000 B.H.P. may be published later.—Editor.]

For a given power output, the cylinder dimensions are relatively small, and engines up to 2000 rated B.H.P. are built in four-cylinder units while engines of larger output are built in six-cylinder units; thus these engines occupy a minimum floor space, and have the smallest possible number of moving parts. At the same time the facilities of operating and maneuvering the engines are equally good for both the four and six cylinder units. As there is one power stroke per cylinder per revolution, a very uniform turning moment results, and comparatively small flywheels are necessary to insure a uniform rotative speed.

As stated above, the power output of a cylinder of given dimensions is very high, which makes it possible to build these engines for a low speed. This is essential for ship propulsion if a high propeller efficiency is to be obtained. Thus the revolutions of engines from 1500 to 4000 B.H.P. range from 120 to 90 R.P.M., and still the weight of the engines is within a limit of 230 pounds per B.H.P.

One of the accompanying illustrations shows the construction and arrangement of a four-cylinder Sulzer type marine Diesel engine of large output. The multistage compressor is always integral with the engine, whereas the scavenging-pump may be either integral with the engine or independently driven in which case an electrically driven turbo blower is used.

The engines are of the crosshead type and offer all the advantages of both the enclosed and the open type. The crank case is made in sections provided with large openings which give free accessibility to all moving parts. The openings are closed and made oil tight by suitable doors, or covers. All main moving parts are provided with forced feed lubrication.

The cylinder liners and cylinder heads, parts to which all Diesel engine builders and users give their closest attention, have been designed with greatest care, to secure simple symmetrical castings, free from internal or heat strains, and provides for uniform and efficient cooling of these parts. For instance, the cylinder head has a single central opening for the fuel and starting valve cage, therefore it is absolutely symmetrical and very simple, and very effectively cooled.

The piston-cooling device, a very important detail in the Diesel engine, is of the Sulzer standard spray-type telescopic tubes, without stuffing boxes, and sea water is used for piston cooling as well as for the rest of the engine cooling.

The reversing gear is a very simple device as fuel and starting valves only have to be operated. Two cams and two rollers are provided for each fuel and starting valve respectively, and the operations of reversing the engine consists simply in shifting the rollers into working positions with their corresponding cams. This system further provides for an adjusting range by means of which the injection air admission can be controlled, thus insuring regular firing and perfect combustion in all of the cylinders at as low a speed as one-third of the normal speed of the engine. The reversing gear interlocks in such a manner as to prevent faulty maneuvering on the part of the operator, thus making the mechanism as nearly "fool proof" as possible.

All parts of the engine which are subject to wear and tear are easily accessible, and the design provides for a quick and easy dismantling. In the manufacture of these engines, the latest and most up-to-date methods are employed, jigs, templates, and gauges being used, which insures like parts being identical and interchangeable.

The fuel consumption of these engines is very low, due to the high thermal and mechanical efficiencies of this type of engine. The fuel consumption chart represents average test results obtained from the Sulzer four cylinder, two-cycle, Diesel engines of 1500 normal rated B.H.P. at 150 R.P.M. for Diesel electric drive, the heat value of the fuel-oil averaging 18,000 B.T.U. per pound. As cheap residue oils are successfully used, the expenses for fuel for operating these engines are low. The lubricating-oil consumption is very low, being less than 0.004 pounds per B.H.P.

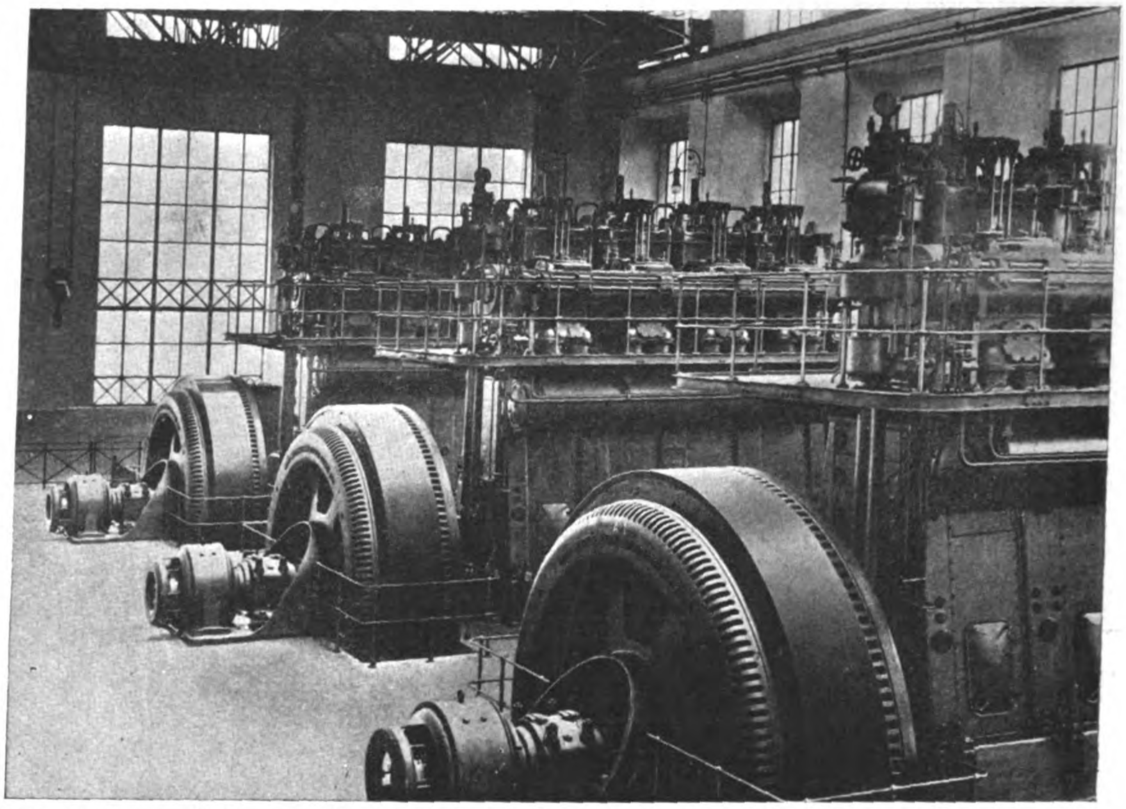
The total horsepower of engines of this one size, built and put into service in the last few years, is nearly 50,000 B.H.P. and many of these engines, according to the requirements of their services, are making non-stop runs of several weeks.

The fuel-consumption chart shows the average fuel consumption of the small Sulzer four-cylinder, two-cycle, marine Diesel engine of 420 B.H.P. at 200 R.P.M. The total horsepower of this one size, built and put into service in the last few years is nearly 35,000 B.H.P.

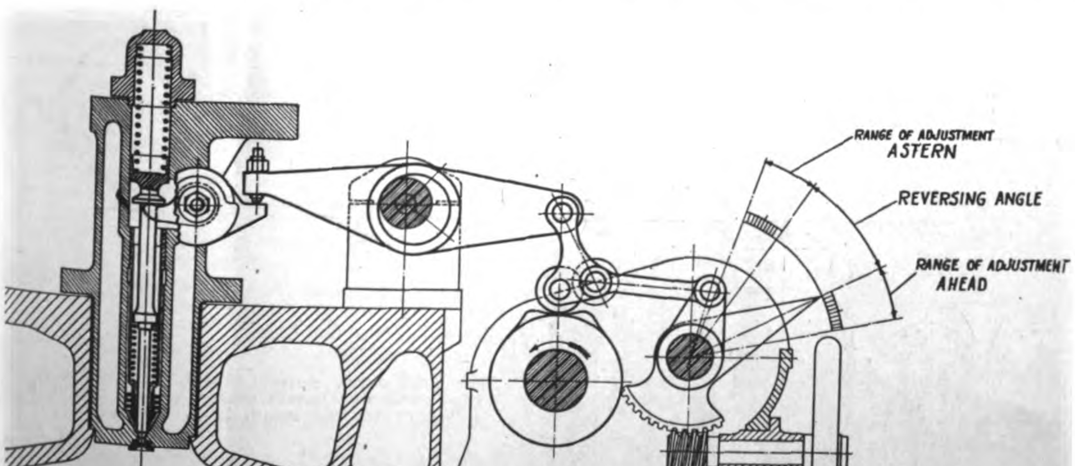
An illustration is given of one of the two largest Diesel engines in service; namely, a Sulzer two-cycle Diesel engine of 4000 B.H.P., with the following characteristics:

Number of Cylinders......	6
Cylinder Bore..............	760 m/m (29.921 inches)
Stroke	1020 m/m (40.157 inches)
Revolutions per Minute	132

A number of engines of these dimensions are in service. In this connection it is worth while mentioning that one of these engines has been in service for the past thirty-two months, and has a normal working time of 126 hours weekly, viz.: the engine is started on Monday morning, and



In view of the possibilities of, and proposals to use, Diesel-electric drive for cargo-ships these three 1500 b.h.p. Sulzer-Diesel engines will be of interest. They develop their power at 150 r.p.m.



Illustrating reversing-mechanism arrangement

shut down the following Saturday noon. The weekly load chart shown was taken from this engine.

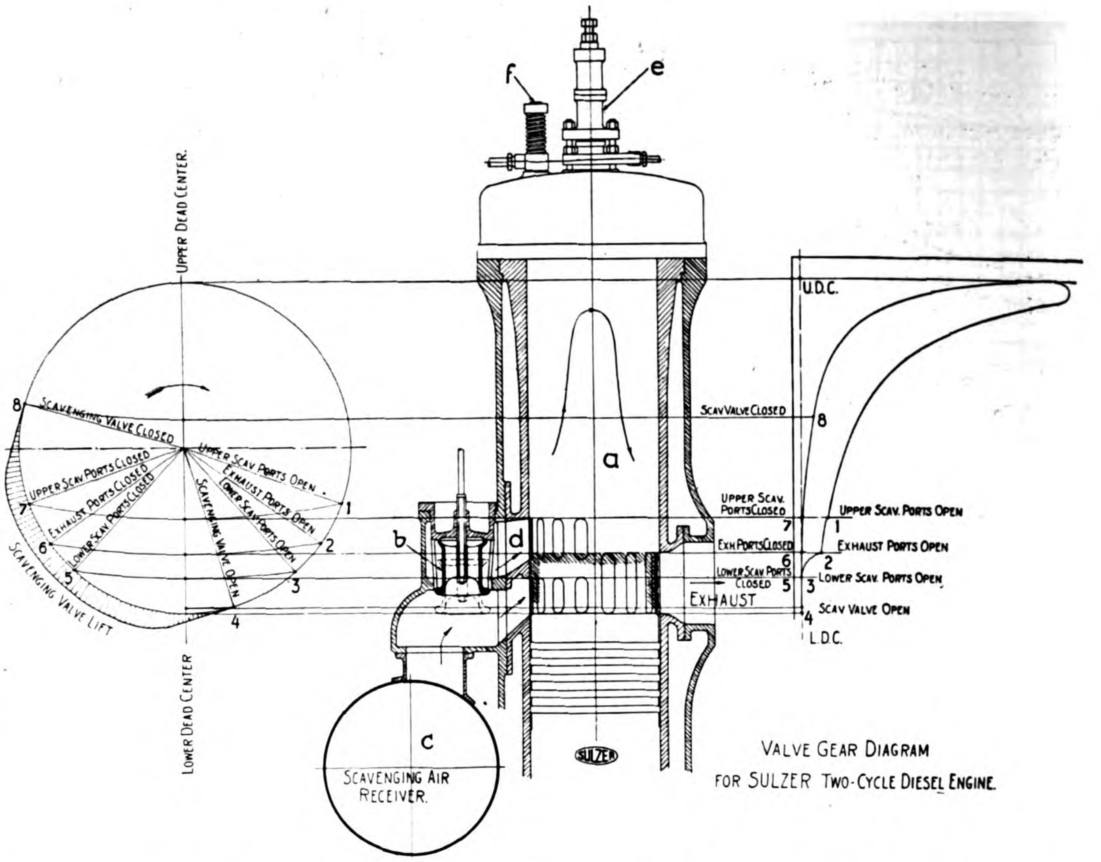
The illustrations will give the reader a good idea of shop equipment and facilities for doing this work. They show some of the large special machines used in finishing some of the heavy engine-parts. The view of the test stand shows two marine Diesel engines of 1600 B.H.P. each, at 110 R.P.M. on test, and illustrates the equipment of the Sulzer shops for testing their engines. These two engines are now driving a twin-screw motorship.

[The American interests of Sulzer Freres are handled by the Busch-Sulzer Bros. Diesel-Engine Company of St. Louis, Missouri. By an arrangement made between the two companies in February, 1911, the Busch-Sulzer Bros. Diesel-Engine Company secured the American manufacturing and selling rights of the entire line of Diesel-engines built by Sulzer Freres.—Editor.]

OIL ENGINES AND REDUCTION-GEARING FOR MERCHANT SHIPS

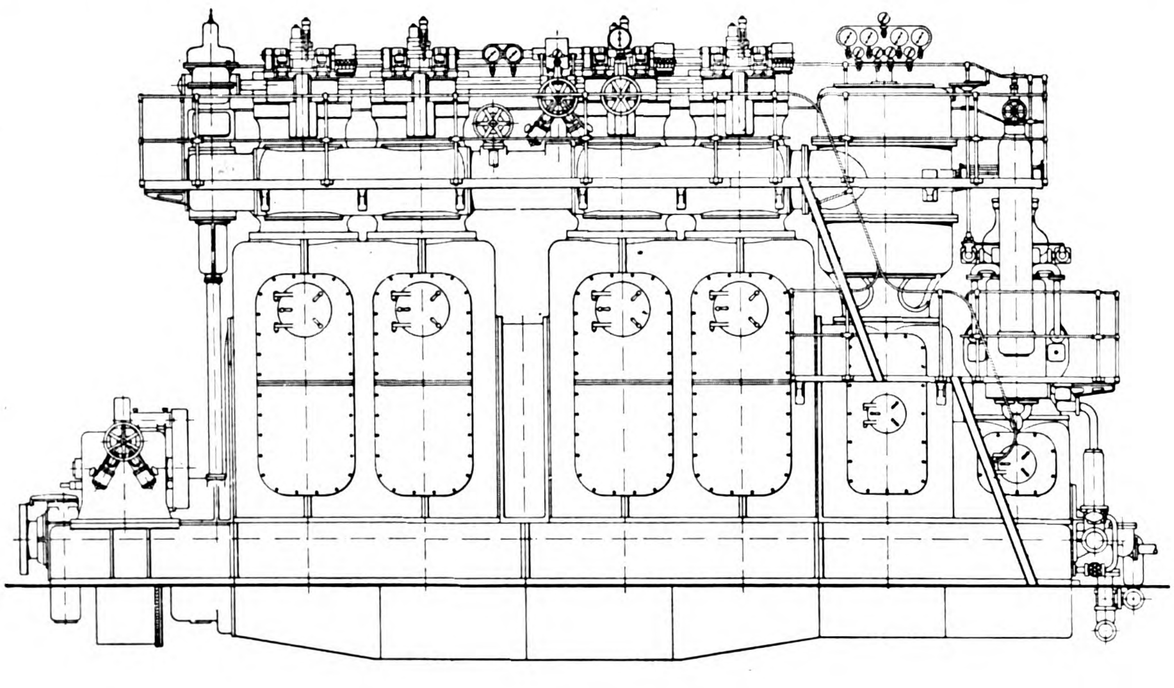
[In the April issue of "Motorship" appeared a lengthy contributed article on the question of the employment of electrical drive for merchant vessels, the writer of the article advocating only direct-drive with slow-speed oil engines. Another writer now suggests the employment of high-speed engines and reduction-gearing. Whilst we publish his views, we do not necessarily associate ourselves with his opinions. In fact, we are inclined to think that the uneven forces of a reciprocating engine are apt to prove severe on the gearing, because the strains are imposed upon a limited number of teeth instead of evenly upon all the teeth, as in the case of steam-turbine drive. Even with the latter, gear-reduction is giving a considerable amount of trouble at the present time, with ships recently built. However, the entire question is one for marine engineers and shipowners to decide, as in the case of electrical drive. We welcome letters on the subject—Editor.]

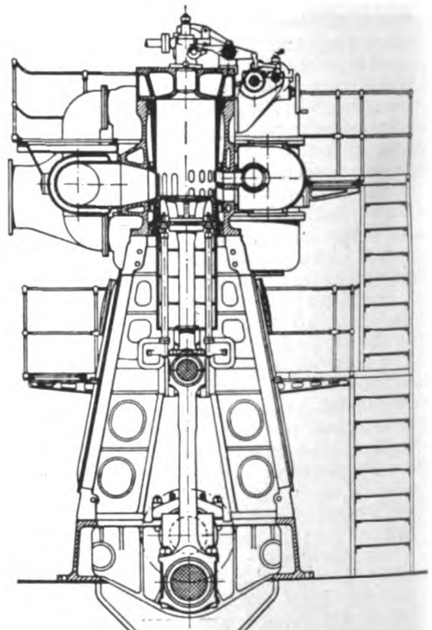
One thing stands out above all others in this war in regard to Diesel engines, viz., the extraordinary and apparently complete reliability of the type of motor used in submarines, which has enabled underwater craft, even of the class built before 1914, to make long voyages and to remain at sea for periods much more lengthy than was ever thought possible before the war.

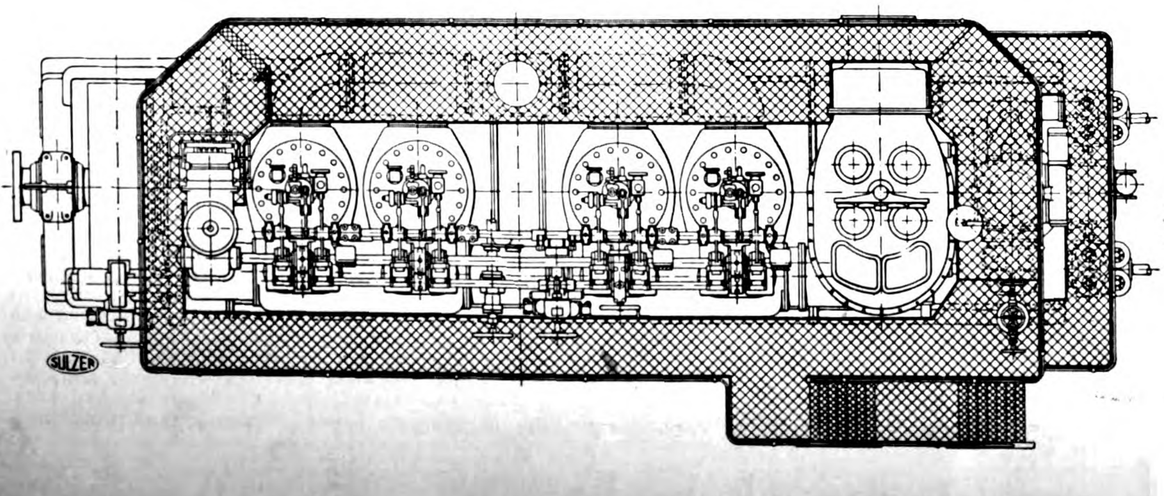


The question follows naturally from this whether it is not feasible to make use of this proved reliability in motors built for commercial vessels, and thus hasten the development of the motorship more rapidly than could otherwise be expected. And although objections readily come to mind, the whole question is worth analysing from a rather different aspect than what would have been adopted a few years ago.

Let us first consider the advantages that would accrue with the employment of submarine type Diesel engines for the propulsion of cargo ships. Generally it may be said that the most successful designs in all countries vary from 800 b.h.p. to 1500 b.h.p., running at 300 to 400 r.p.m., and weighing from 50 lb. to 70 lb. per b.h.p. Obviously, for a cargo vessel, when the most efficient propeller speed is between 60 and 100 r.p.m., it is necessary to adopt some form of gearing, and if this be successfully done, the propeller speed can be reduced to 60 r.p.m. for full ship's speed instead of a minimum of 100 r.p.m. or more, which is almost universal with direct-coupled Diesel engines. This reduction in speed will naturally give a con-



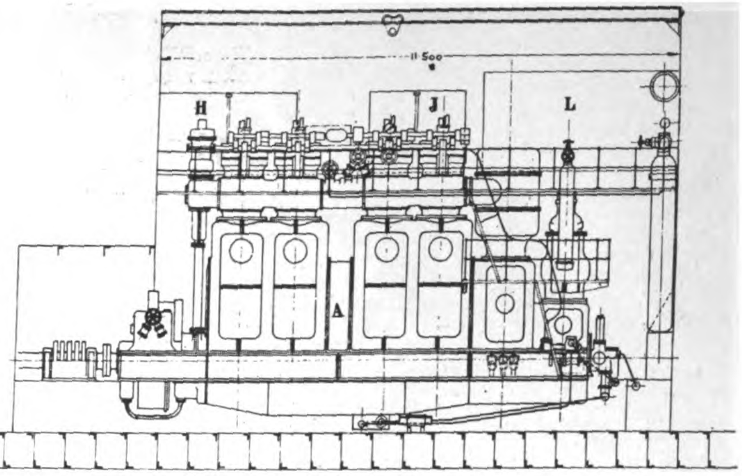


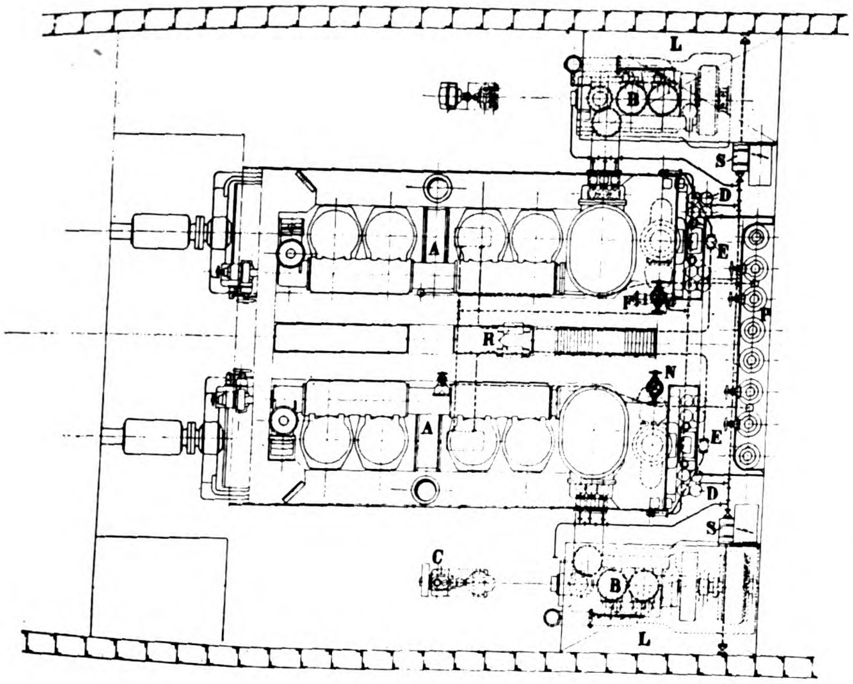


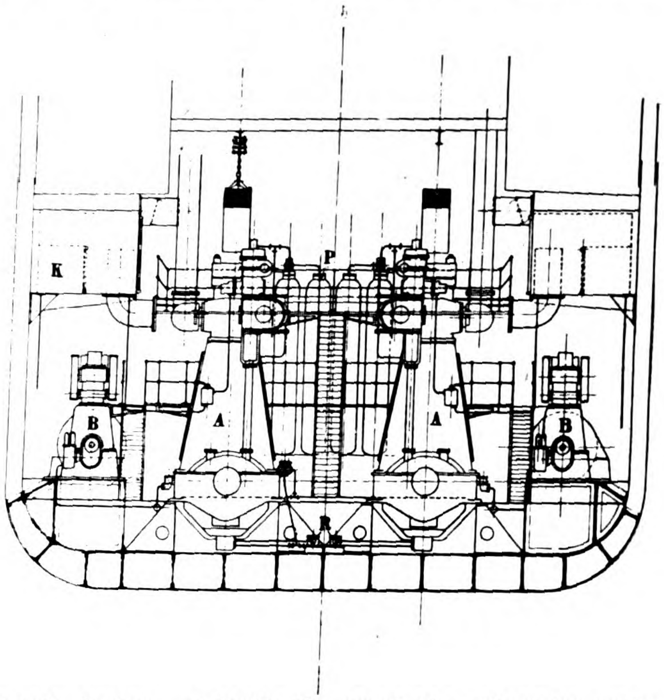
The 1350 b.h.p. Sulzer Diesel Marine Engine. This is the very latest design, and its output is equivalent to 1485 steam i.h.p.

General arrangement of a 2600 b.h.p. (2850 i.h.p.) Sulzer Diesel-engined twin-screw motorship. Each main engine develops 1300 shaft h.p. at 120 r.p.m. The auxiliaries are two 120 h.p. motors at 300 r.p.m.

A Main Engines
B Diesel-Dynamo
B Diesel-Compressor
C Auxiliary-Compressor 70 H.P.
D Cooling-Water Pump
E Lubricating-Oil Pump
F Worthington Pump
H Fuel-Tank
J Lubricating-Oil Tank
K Cylinder Lubricating-Oil Tank
L Suction-Room for Scavenging-Air
M Ballast Pump
N Injection-Air Bottles
P Starting-Air Bottles
R Oil Filter
S Cooling-Water Filter







siderably increased overall propulsive efficiency as compared with the ordinary motorship.

Some loss, of course, in the gear itself, which, however, amounts to only 2 per cent. or 3 per cent. at most, and the fact is to be noted that during the past few years mechanical gearing as used with the geared turbine has enormously improved, and may be taken as perfectly reliable. which was scarcely the case when the quest on of geared marine Diesel engines was brought forward some years ago, and indeed put into operation in some Russian boats. [These were not reduction gears—Editor.]

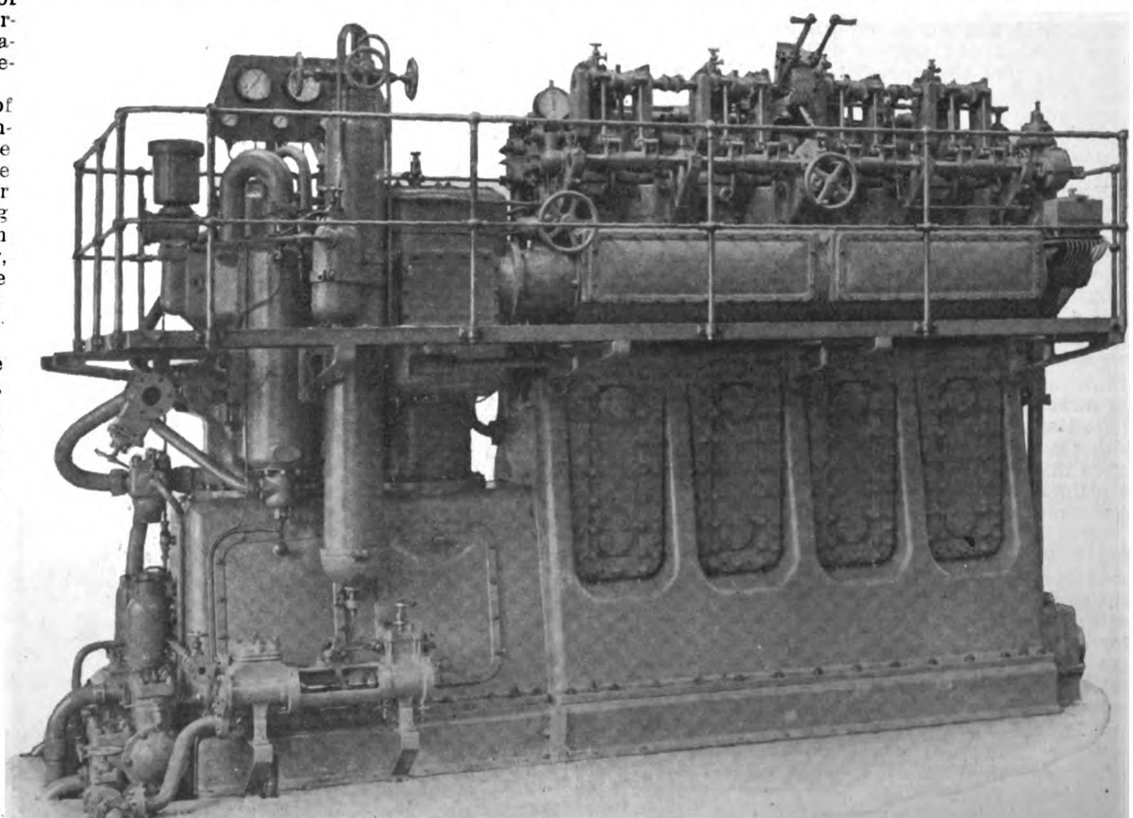
The reduction in space occupied and weight of machinery in a geared Diesel-driven ship as compared with a motor vessel having a direct drive would be enormous, since the former could be reckoned at 30 b.h.p. per ton, while in the latter only 10 b.h.p. per ton would be realized, showing an economy of 200 tons in a 3000 h.p. ship. In order to take full advantage of this fact, however, Board of Trade regulations as regards tonnage measurements should be modified, but it is understood that in any case these will come up for consideration after the war.

These two points are important enough, but the most vital is that owing to stress of circumstances, in all countries, numbers of good engineering firms have gained very considerable experience during the past few years, in building the submarine type of Diesel engine. The result is that it is thoroughly standardized, and could be turned out cheaply in spite of some of the materials employed being more costly, but when it is remembered also that only one-third of the material is employed, it is not difficult to see that manufacturing costs could be brought fairly low, and certainly a good deal lower than with the modern low-speed engine.

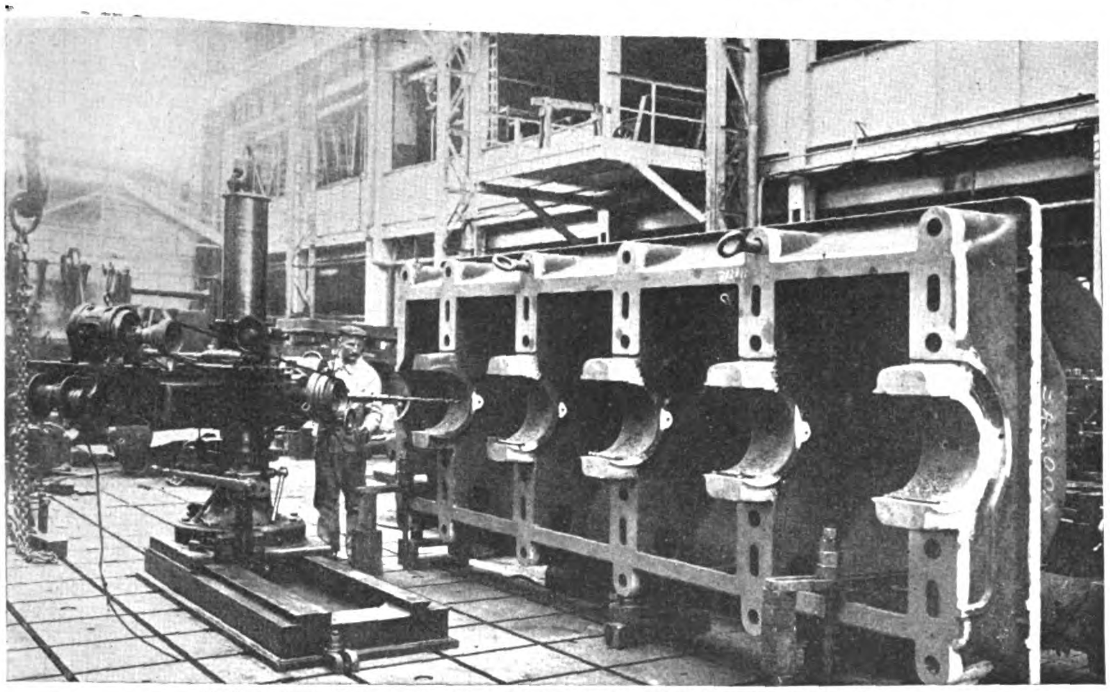
For the same reason (that so many firms have taken up the construction of submarine engines) they could be built quickly and with complete reliability, and the possible delays in the manufacture of big mercantile type Diesel motors would thus be avoided.

With these facts to the credit side of the geared Diesel engine proposition it must also be admitted the disadvantages are not negligible. The oil consumption of the high-speed engine is some 10 per cent. above that of the slow-running design, which would more than counterbalance the extra efficiency of the slower-running propeller.

Secondly, the high-speed set, although having now reached a high level of reliability, is obviously a more delicate machine, needs greater care in operation, and presumably cannot be accorded so long a life as the slower type of engine. On the other hand, this objection must not be magnified out of all proportion to its importance, for we have motorcar engines running daily for 15 years at double the speed of a submarine engine, still apparently capable of another 20 years good work. But it need not be denied that the two cases are not exactly on a par, since the complications of a 1000 h.p. Diesel motor are much greater than those of a 30 h.p. gasolene engine. Then the average load of the latter in a car on the road is very light, while only a small percentage of each 24



77 of these 450 B.H.P. Sulzer Direct-Reversible Marine Engines have been built for Naval and Mercantile Ships



Drilling the oil passages in a Sulzer marine Diesel engine bedplate

hours is spent in actual running, whereas in a ship at sea the engine runs continuously, day and night, only being stopped when the vessel is in port.

Electrical enthusiasts would no doubt urge the claims of electrical transmission in place of the mechanical gearing suggested above, but this modification would largely discount the saving in weight and space without introducing any compensating advantages, at any rate for cargo ships, as oil engines are directly reversible, while their flexibility and ease of control have been found fully equal to the requirements of such vessels.

It is to be understood that neither engineers nor shipowners will readily agree to the employment of high-speed internal-combustion engines in vessels where the machinery has to run day and night for weeks on end, for there is a sort of instinctive feeling that they are not suitable. But first the prejudice against the oil engine as an oil engine has been broken down, and secondly, to some extent, that against high-speed machinery, both by the success of the geared turbine and the pronounced reliability of submarine engines. Those responsible for the choice of type of propelling machinery in new ships should therefore view the problem in a somewhat different manner than before, and it is by no means impossible that far greater success would be achieved than might be thought.

Having expressed the advantages and disadvantages as they appear to him, the writer is of opinion that the geared Diesel engine is at least worth a trial, and whilst not wholly confident that no unexpected and serious difficulties would not arise, feels that the prospects of satisfaction and profit to the owners adopting the system are distinctly hopeful.

REMARKABLE NEW BRITISH CONCRETE HARDENING LIQUID

We recently referred to the new composition discovered by the U. S. Shipping Board for hardening the concrete used in ship construction. Almost simultaneously comes news of a similar invention from Great Britain, where there now are 20 concrete shipyards. It is claimed that the effect of this liquid, which is transparent and of waterlike appearance, is to harden the concrete in a very short time, and to render it unaffected by contact with sea water, and therefore it is of great importance in connection with concrete shipbuilding. It is estimated to add 25 per cent to the strength of the cement, besides preventing the formation of fissures or cracks, and, being absolutely oil, acid and waterproof, tanks may be formed from such concrete which will hold liquids of all kinds without any sign of leakage for an indefinite time, and will allow of a thinner and lighter skin being used for the hull of a ship and prevent water rusting the steel. When applied to wood or woven fabrics it renders them fireproof and rotproof without affecting the appearance of the material in any way. This is of great importance to all connected with or in any way interested in the construction of motor vessel of either wood or ferro-concrete. All kinds of timber can be damp-proofed by this liquid rendering it immune from the absorption of moisture, thus also doing away with any risk of swelling, splitting, warping, or similar defects, and it is invaluable in cases of dry rot.

The strength of the wood is not impaired, neither is the natural working affected, but by effectually closing the pores this liquid acts as a filler, and thereby affords a capital ground for paint. Vickers Ltd., the British naval shipbuilders, have carefully tested this new liquid. "Motorship" gladly will place firms interested into communication with the firm producing this metallic liquid.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, of Motorship, published monthly at New York, N. Y., for October 1, 1918.

State of New York, County of New York, ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared T. Orchard Lisle, who, having been duly sworn according to law, deposes and says that he is the editor of Motorship, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Miller Freeman, 2606 Smith Bldg., Seattle, Wash.; Editor, Thos. Orchard Lisle, 44 Whitehall St., New York, N. Y.; Managing Editor, T. Orchard Lisle, 44 Whitehall St., New York, N. Y.; Business Manager, Russell Palmer, 2606 Smith Bldg., Seattle, Wash.

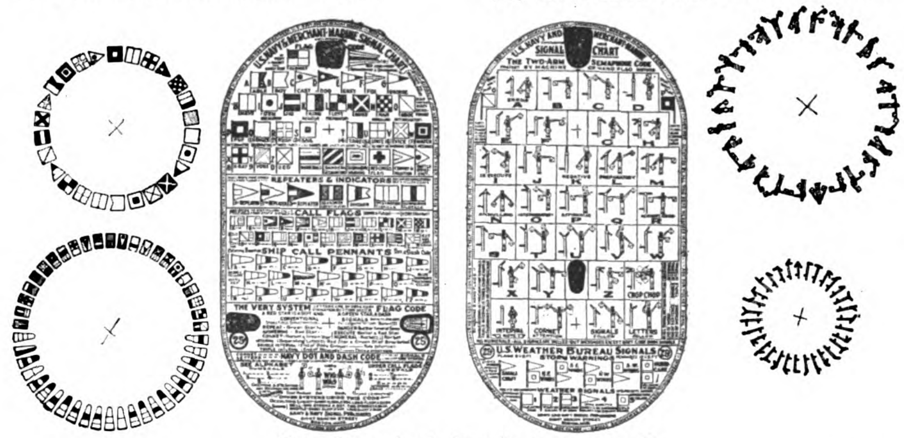
2. That the owner is: Miller Freeman, Seattle, Wash.

3. That the known bondholders, mortgagees, and other security holders owning a holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe tnat any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. T. ORCHARD LISLE.

Sworn to and subscribed before me this 19th day of September, 1918. (Seal) T. CARSON BUNCE.

(My commission expires March 30, 1918.)



Signalling chart described on page 30

THE AUSTRALIAN GOVERNMENT'S FOUR MOTORSHIPS

To the Editor of "Motorship":—

Sir:

We are interested in the advertisements carried by Messrs. McIntosh & Seymour in the various trade papers, especially the one in the "Motorship," giving the operation of the "Cethana." While she and her three sister vessels are now owned by the Australian Government, they were originally contracted for with this Company.

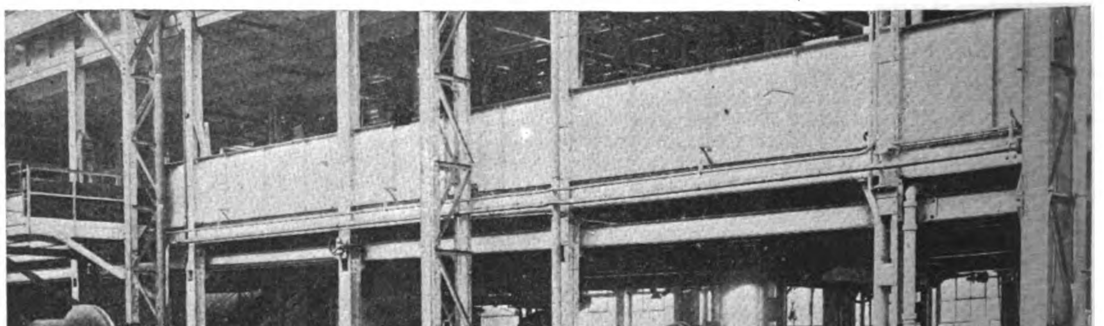
Yours very truly,

CHAS. M. BARNETT

Vice President.

Clinchfield Navigation Company, Inc.,

New York, N. Y.



Machining the 440 mm. diameter crankshaft of a four-thousand brake-horse-power (4000 b.h.p.) Sulzer-Diesel Engine

Operating America's Merchant Fleet After the War

By A. H. MORNER

SUCCESS in the present war is largely a matter of tonnage. The great shipbuilding program which this country has decided upon is a war emergency and is a measure decided upon as being one of the factors absolutely necessary to insure victory; but, on the resumption of peace, this country will find itself the owner of a great Merchant Marine, while the conditions which were the cause for building same will have ceased to exist. The question will then be, Is America better situated now to meet the competition of the foremost maritime nations or must she see as before the overseas carrying trade fall into the hands of others? Therefore, although the war and victory at the close of same, are the reasons for this country's wonderful creation of a great merchant fleet in record time, it should not be lost sight of even from the start that this fleet will have to fight eventually for its existence in the general competition for trade, and the developments should therefore take place on such lines as will assure it the greatest possible efficiency as long as these phases of the developments do not hinder in any way the main object in view, namely—the winning of the war.

Reasoning on the above lines therefore I should like to call attention to the following:

Before the war, and ever since the advent of modern freight and passenger steamships, America never succeeded in creating a merchant marine of its own worthy of the name. The reason for this is not to be found so much in the initial cost of the vessels; American ship yards have shown themselves capable of building vessels as fine, and at as low a cost as their European competitors, and as a proof of this I need only mention the large freight carriers of the Great Lakes.

No, the reason is to be found in the high running expenses of all vessels flying the American flag. The wages of both officers and crew have been on the same high standard obtained by the American employee on land. The standard of living has also been high on the ships in this country compared with those of other countries, and it is for these reasons that since America has entered into competition with other nations in international marine commerce, and it has been found impossible to cut down the running expenses in other respects than the manning of the vessels; the attempt has been doomed to failure.

The question is then, Must the same thing occur after the war? It is of course impossible to answer this question with any degree of certainty, but, nevertheless, much could be done to avoid such a failure, and amongst other factors tending in this direction I should like to point out two which would probably constitute a greater direct gain than any others.

I allude now to the introduction of new systems of propulsion, which would permit cutting down the number of the crew, and the adoption of new methods of loading and discharging, thereby shortening the time spent in port.

America has dominated and still dominates the world's market in some special lines, for instance in the automobile industry, the manufacturing of typewriting machines, and sewing machines, machine tools, and agricultural machinery etc.

As pointed out so succinctly by Mr. Hurley in a recent speech, this is not because the American working-man has been paid less for his work, but because in the manufacturing of these various machines methods have been adopted which are entirely American, and have had in view the reduction of manual labor to a minimum. In this way it has been found possible to increase the out-put per workman. The same feature is to be found in several other of the great industries here, namely in the manufacturing of steel, and production of coal.

Similar principles will have to be adopted with regard to the operating of the future merchant marine in this country. Methods must be introduced whereby the number of the crew of a vessel can be reduced. The only way to do this is to adopt machinery above and below deck that will require a minimum number of men for its attention, and in this respect lead all other nations in this development.

With regard to the machinery under deck I think we can best realize the result desired by the use of oil-engines.

The difference in the number of engine room crew of a 3,500 ton D.W. ship equipped either with steam engines and oil burning boilers, or equipped entirely with internal-combustion engines is as follows:—

	Engineers	Oilers	Firemen	Stokers	In all
Steamer, coal boilers..	4	3	6	4	17
Steamer, oil boilers..	4	3	4	—	11
Oil-engined ships...... (Internal combustion engines)	4	3			7

The economical advantages of the motorship as compared with the steamship fitted with oil-burning boilers are too apparent to necessitate any discussion, and although the difference between the former and the steamship fitted with oil-burning boilers is somewhat less, nevertheless the advantages of the motorship over this latter are not only to be found in the economy of space and reduction in the number of the staff under deck; but also in the considerable saving of fuel oil, the consumption of same on the motorships being only 1/3 to 1/4 that of the steamship fitted with oil-burning boilers.

It would seem therefore quite evident that the most economical freight carrier of the near future will be the internal combustion oil engined vessel and this country's new merchant marine should be equipped with such. It is true that for many people the internal-combustion engine has not the reputation for sufficient reliability to warrant it being adopted generally as the marine propulsive force in merchant vessels, and this to a certain extent seems warranted. Oil-engined vessels in this country have not proved in all cases the unqualified success that was expected, but I think the reason for this will be found in the deficiencies in the experience of the operators and not in any inherent defect in the engine either in the design or construction.

In foreign countries, for example Denmark, Sweden and Norway, oil-engines have been in use in large sea going freighters for several years with complete success, the engine staffs of these vessels possessing the necessary experience and knowledge to make these installations perfectly reliable, so much so that several large shipping companies like the Ostasiatisha Kompaniet, Denmark, and the Johnson Line, also the Transatlantic Line, both of Sweden, have chosen oil-engines exclusively for their latest and future vessels, and this in spite of the high price and difficulty of obtaining fuel-oils in the above countries.

What must be done then in order to put the internal-combustion engine on the same base in this country?

It is clear that a large staff of engineers in this country must be educated up to the requirements of the modern oil-engine. It will cost some efforts and some money; but with a merchant marine equipped with oil-engines cared for by a body of skilled operators, it will be possible for this country to meet competition in this branch after the war more successfully than she could by any other means. It will undoubtedly take time to acquire a capable body of oil-engine operators, and during the time it is in the making I am afraid the already discredited oil-engines will suffer still further in reputation; but if the matter is taken in hand energetically and without further loss of time, this intermediate period need not be so long nor interfere seriously with the working of the vessels.

No half-hearted measures however will cure the ill in question. Oil-engine manufacturers must educate engineers in their shops and means afforded to give these men the necessary experience under sea going conditions and the supervision of already experienced operators.

The difficulty in all this lies in the fact that there are at the present time so few really experienced and capable oil-engine engineers in this country and if the difficulty is to be overcome within measurable time, such men must be loaned from the countries who possess them, which are the three countries alluded to above.

How the men are procured is immaterial; it is only a temporary measure, an emergency act to make possible the realization of an American Merchant Marine operated under the most economical and efficient conditions, and this result is of sufficient importance to warrant even the most drastic measures in order to accomplish same.

One of the Thornycroft built and engined speed motor-boats used at the Ostend & Zeebrugge raids.

OUR COVER PICTURE

The fine-looking motor-vessel on the front cover is the M. S. "Fionia," a cargo and passenger carrier of the East Asiatic Line, and it's one of a fleet of about 15 Danish Diesel-driven merchant ships. She is 395' long by 53' breadth 36' molded depth and 24' 3" loaded draught. Although she has luxurious accommodations for 40 passengers, (each state room also having a private bath) she can carry about 1000 tons more cargo than a steamer of her size and speed, her hold capacity not including bunkers, having space for about 6,500 tons of general cargo.

Her twin six-cylinder B. & W. four-cycle type Diesel engines together develop 4,280 I.H.P. at 106 r.p.m. at which revolutions they drive her at 14.0 knots to 14.1 knots on a fuel-consumption of 103 barrels (7¾ tons) per 24-hour day. At 100 R.P.M. her loaded speed is 13½ knots.

Although this remarkable motorship ran her trials in December, 1913, America still is without a similar ship. Well may we ask ourselves why?

MR. VAL FISHER'S MESSAGE

(Continued from page 6)

"What are you going to do with your acres and acres of enlarged factory space now employed in the making of war produce all over America, if you don't build good-will now for the goods you are going to make when the war is won? How are you going to keep the smoke coming out of your factory chimneys after peace is declared, if you don't keep your name constantly before the public now, and build a demand for your peace-time products that will insure a satisfactory business the minute you stop making munitions or other war supplies?

"These are times of rapid and tremendous change. No man can rest on his laurels. Those who were leaders last year, those who are leaders now in their respective business lines, may be surpassed next year by far-seeing, efficient, and thoroughly-prepared competitors who have laid their plans in advance."

Mr. Fisher's warning can bear not a little very serious reflection by all shipbuilders and by manufacturers of marine engines and ships' accessory equipment.

MR. HURLEY AND AFTER-WAR TRADE

Since writing our editorial leader on post-war maritime commerce on page 5 of this issue we have noted the remarks of a writer in the Liverpool (England) "Journal of Commerce." This is what the correspondent says:—

"I am afraid that Mr. Hurley has been too precipitate in writing to "The Times." If he can carry the whole of the business world with him in his desire to help us, well and good; but from what we know of American commercial ideas, I don't think he will have any considerable following. No, we have got to expect very severe competition from the United States. Japan also has to be countered."

These remarks are worth reading in conjunction with our editorial as they may indicate impressions in Great Britain.

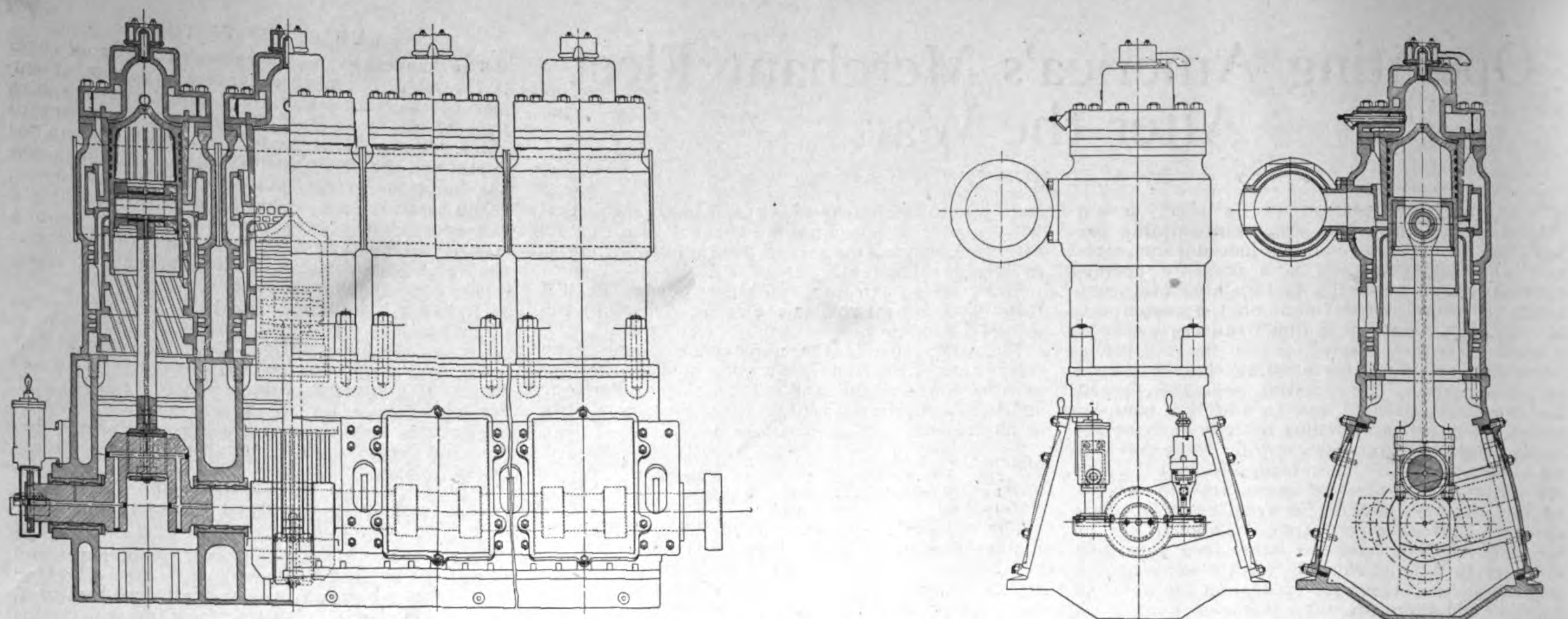
CANADIAN-BUILT DIESEL MOTORSHIPS FOR FRANCE

It is reported that ten Diesel-driven motorships will be built for the French Government by the New Westminster Construction & Engineering Company, Poplar Island, New Westminster, B. C. Canada. Five will be of 3,000 tons d.w.c. each and five of 1,500 ton d.w.c.

OIL ENGINEERS WANTED FOR THE U. S. NAVY

The U. S. Navy Gas Engine School, of which Lieut. Commander Charles E. Lucke is director at Columbia University, New York City, is desirous of obtaining the names and addresses of men who are willing to enroll for training for the position of chief-engineer, warrant machinists and chief machinist mates on board the new submarines of the U. S. Navy. Such applicants must be men who have had extended experience in the operation of Diesel or other heavy-oil engines. They must be fully capable of taking charge of Diesel engines and making ordinary repairs and be competent to foresee trouble, and maintain the engines in efficient operation. Only those possessing such qualifications can be considered. Such applicants should be between the ages of 21 and 35, but the applications of men up to 40, if exceptionally well qualified, will be considered.

The rates of pay are most attractive and the several months training which applicants accepted for this work will undergo is most advantageous and will fit them for positions of larger responsibility than most of them now are capable of. Anyone possessing the above qualifications and desiring to serve in this most important work should send their names and addresses in to Lieut. Commander Lucke at the above address.



Sections and general arrangement of the Weiss 400 b.h.p. Marine oil engine

The New Weiss Marine Oil-Engine

Radical Departures from Recognized Practice

By THOS. ORCHARD LISLE, A. M. S. Naval Engineers; A. M. S. Marine Engineers

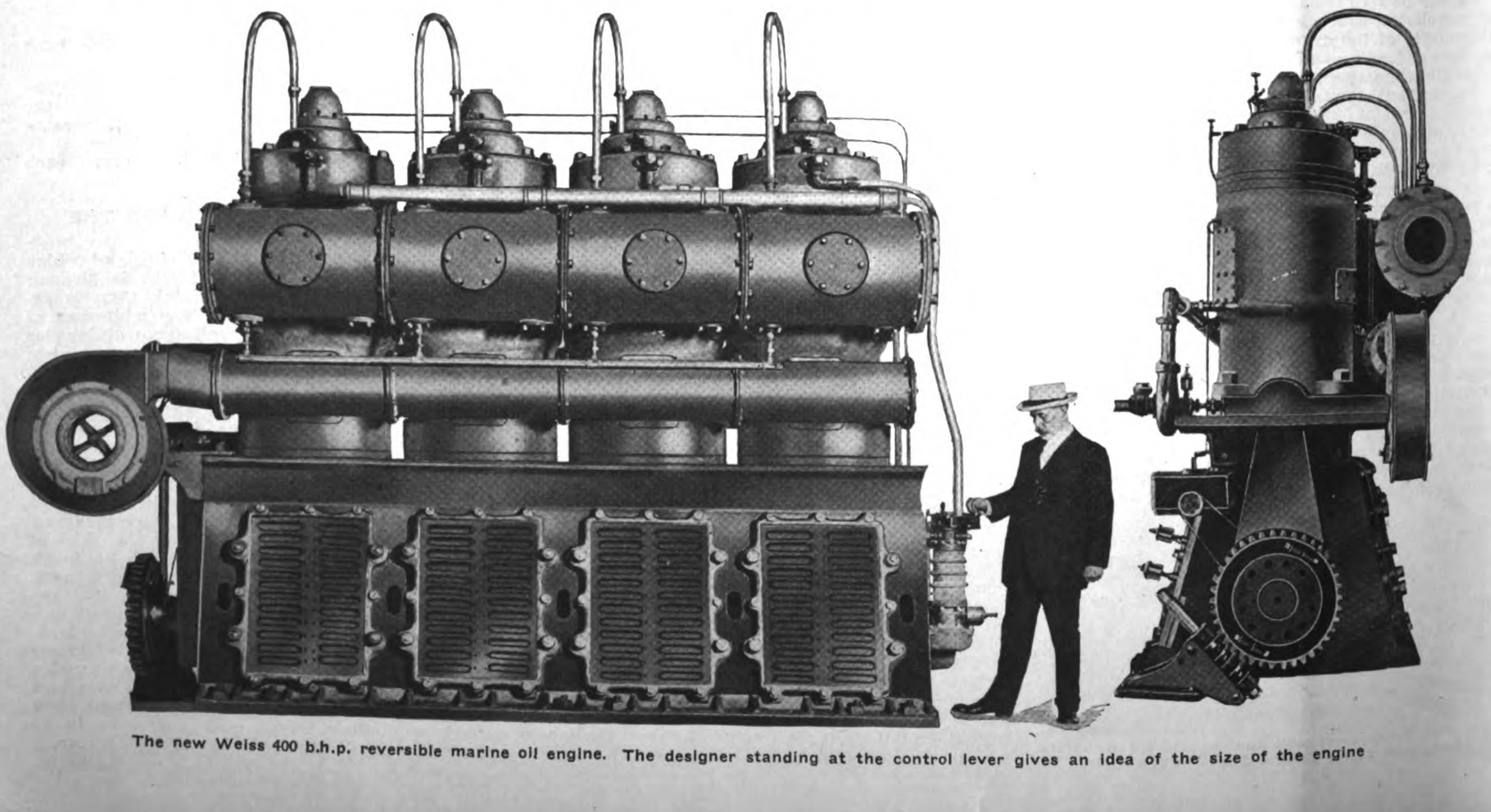
BACK in October of last year this journal published the career of Mr. Carl Weiss, one of the pioneers of the marine oil-engine in the United States, and how in 1894 he designed and produced a two-cycle type oil-engine of the surface-ignition class since when about ten thousand marine and stationary internal-combustion engines of his design have been built, he for many years having been associated with the old Mietz & Weiss Engine Company.

Mr. Weiss now is with the Weiss Engine Company of 17 Battery Place, New York, and the results of his latest ideas and experiments have been incorporated in an interesting new marine oil-engine now coming through production. This engine, of which we illustrate a four-cylinder 400 b.h.p. model, is built in four, six and eight cylinders. It is of the single-acting class, and its special feature is a new method of scavenging.

In the ordinary type of two-cycle surface-ignition, medium-compression oil-engine, a baffle-plate piston is normally used in conjunction with crank-case or scavenging-pump compression for scavenging. It is Mr. Weiss's opinion that the baffle-plate piston, by its very construction, leads to uneven thicknesses of metal which, in its turn, leads to uneven contraction and expansion, and frequently has resulted in cracked piston-heads, he personally having experienced this trouble in the past, so has experimented extensively with a view to avoiding the same. By referring to the accompanying illustrations, it will be seen that the piston-top in this new engine is conical, which is a rather radical departure from accepted forms. A little later it will be explained how this conical piston operates in conjunction with the new scavenging method.

Referring again to the drawings of the four-cylinder engine, there is a crank-case cast in one piece to which the cylinders are bolted. There are five bearings with regular bearing-caps for access to the bearing bushings, and the removal of the crank-shaft sidewise, which can be done without interfering with any of the pipings or fittings attached to the engine, and requiring much less room than is necessary for engines in which the shaft can only be taken out lengthwise, or in others where the entire upper engine, that is, all the cylinders complete with upper part of the crank-case must be raised. The air suction-valve in this particular size of engine is attached to the crank-case cover.

The bone of contention regarding the relative efficiency of the surface-ignition, medium-compression, two-cycle oil-engine has been scavenging, it being contended by some engineers that previous types of this style have not completely burned the charge or completely cleared the cylinder of burned gases after each explosion, and as just mentioned in this new engine Mr. Weiss has incorporated an entirely new method of scavenging. There are three annular sets of incorporated central ports (one) the exhaust, (2) the supplementary, and (3) the crank-case port. The supplementary ports are open to either atmospheric or under low pressure of air supplied, as in this instance, by a small pressure blower. As the piston uncovers the first series—the exhaust ports—near the end of the expansion stroke, the pressure in the cylinder drops to atmosphere, and due to the abrupt discharge and the forcible cooling of the gases, the pressure at once goes down to several points below atmosphere. At this point the supplementary ports



The new Weiss 400 b.h.p. reversible marine oil engine. The designer standing at the control lever gives an idea of the size of the engine

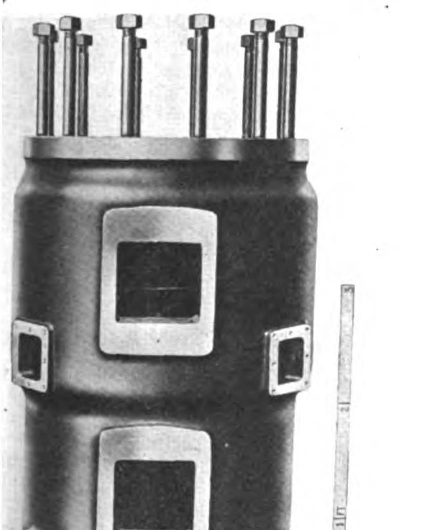
open, allowing a charge of pure air to sweep in *radially* over the conical piston-head, displacing the exhaust gases left in the cylinder, whilst immediately following this as the crank moves through the lower dead center, the crank-case air under approximately five pounds pressure per square inch also flows in over the conical piston-head by way of the annular series of ports formed by the spirally ribbed lower parts of the cylinder liner.

In this way three completely separate and distinct charges of air are introduced into the cylinder during the scavenging process, which undoubtedly should give a good fuel-efficiency and an ability to operate indefinitely without undue heating of piston-head if practice proves equal to theory.

Every endeavor has been made to reduce the oil-injection system of this multi-cylinder engine to the utmost simplicity. In place of direct-driven governor control injection-pumps, there is an independent duplex pump to keep the oil under constant high pressure, and a compensating distributor-valve, driven from the engine-shaft, arranged for timing adjustment for different grades of oil and either direction of rotation. This pump is connected to the air-receiver used for starting and reversing the engine. With a normal air-pressure of 200 pounds in the receiver, the oil-pressure is kept at 1,000 pounds by a reducing-valve in the air line, as heavy-oils require high pressures for efficient spraying. The governor is designed to act directly on the compensating valve, and is, in fact, carried by the distributor-valve and submerged.

There is a spiral-gear mounted on the front end of the crank-shaft, which drives the oil-distributor on one side and the air-distributor for starting and reversing on the other. Each cylinder has an air check-valve piped to the air-distributor and a relief-valve open to the atmosphere. These relief-valves can be operated either independently or simultanously by a lever at the front end of the engine, so that the entire control of speed, starting, reversing, and pressure relief is brought within easy access of the engineer.

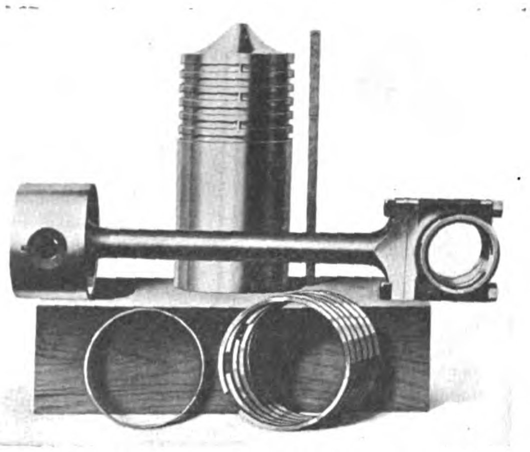
Forced-feed lubrication is used for the cylinder, main-bearings, crank-pin and wrist-pin, and each pipe terminal is fitted with a lubricating sight-check. These lubricators are of the single-plunger, distributor-disk type, made by L. T. Weiss, of Brooklyn, and as used by the United States Government on single and multi-cylinder engines. They



Cylinder jacket of Weiss 400 b.h.p. marine oil-engine. The large upper hole is the exhaust port and the lower orifice is the supplementary air intake

are guaranteed to force oil against 200 pounds pressure. The design shows an eight-feed circle mechanism. A hardened steel worm engages a worm wheel disk, which latter carries a steel plunger with its operating yoke. As the check turns, the two diametrically opposite projections of the yoke and the fixed star-wheel operate as an escapement, reciprocating the plunger, to draw in and discharge oil through a hole in the disk, registering alternately with the suction and discharge hole in the base. Each discharge has a screw coupling for copper tubing. The whole mechanism being simple yet substantial, submerged in oil, with an extremely slow movement.

A noteworthy feature of the engine is that it has no fly-wheel; also it has no special scavenging-pumps. The weight per h.p. is reduced to approximately 150 lbs. without, it is claimed, sacrificing a reliable factor of safety within the limits of working-pressures. At a pressure of 500 lbs. per square inch, the maximum main-bearing pressure does not exceed 509 lbs. per square-inch projected area. The shaft in the $16\frac{1}{2} \times 22$ unit is $8\frac{1}{4}$ inches diameter. The bearing length is $12\frac{3}{4}$ inches. There is a centre bearing between each cylinder in the multi-cylinder type. The bearing pressure,



Piston and rod assembly of the Weiss engine. Note the conical shape to the piston top

therefore, is $500 \times 214 = 107{,}000$, divided by 210 $= 509$ lbs., as stated above, while the mean pressure is below 100 lbs. per square-inch projected area. The mean crank-pin pressure $= 290$ lbs. per inch projected area. The connecting-rod being 5 crank lengths, the side thrust at crank circle tangent is below 40 lbs. per square inch projected area. The piston is $16\frac{1}{2}$ inches diameter, and 33 inches in length, giving a projected area of $33 \times 16\frac{1}{2} = 544$ square inches. The mean wrist-pin pressure averages 475 lbs. per inch. The size of the wrist-pin is $5\frac{1}{2}$ $8\frac{1}{4} = 45.37$ square inches projected area.

Referring back again to lubrication, which undoubtedly is one of the most important features of any engine of the Weiss-type, it should be noticed that this engine uses the force-feed, which is becoming the recognized practice for marine work. The shaft is drilled all the way along the main-bearings, crank-cheeks and crank pins, with an outlet at each bearing and crank-pin, so that with oil under pressure connected to the end of the crank-shaft, all the bearings are flooded with oil and the wrist-pin receives its lubrication from the crank-pin through a hole drilled in the connecting-rod, which is provided with a check-rod running its entire length. When the engine is in operation this rod plays about ⅛ of an inch between the wrist-pin and the crank-box for the purpose of checking the oil which has once passed the rod, and retaining same for wrist-pin lubrication. With this pressure system there is really no need for a special check-rod for the oil in the connecting-rod; but this provision is of considerable advantage, inasmuch as there is no oil in the rod when the engine has been standing for a sufficient time to enable the oil to leak out. With the oil in the rod, the wrist-pin will get its lubrication right from the start, and this prevents any cutting of the bronze bushing which bears against the steel hardened and ground wrist-pin.

Particular attention may be drawn to the illustration showing the conical piston with its even thickness of metal, to the connecting-rod, to the piston-pin carrier and to the piston-pin, whereby it will be noted that the wrist-pin is mounted in a separate carrier which is locked inside of the piston construction calling for heavy bosses on the body of the piston and inasmuch as there should be less heat conducted with the Weiss arrangement, consequently the lubrication durability of the wrist-pin should materially be increased.

In referring again to the piston illustration, there is another feature in the piston which is worthy of notice, and that is the absolutely uniform distribution of metal. The Weiss designers point out that it is impossible to maintain a true circular piston with the old method of wrist-pin supporting bosses, and baffle wall projection, because the heat would immediately throw the piston out of round, and the constant distortion of the piston, due to temperature differences, is apt to loosen the wrist-pin in its bearing, and that to remove this contingency justifies the amplification of a cross head far more than the much exaggerated wear of the cylinder, due to the side pressure of the piston. However, in fairness to other designers, we would point out that truly round pistons are not desired, and that after heat-treatment the pistons are ground slightly oval.

In the new Weiss piston the wrist-pin carrier is independent, and there should be no chance for the wrist-pin to run against the wall of the cylinder, and any expansion of the piston shell, due to temperature differences, theoretically, is perfectly uniform. Particularly is uniform distribution of metal desirable at the head where the temperature is highest.

Engine designers are welcome to space in "Motorship,' to outline their views and experiences regarding features of construction and design, and on another page a well-known French concern support the four-cycle system of operation. Mr Weiss, however, says that

"The four-cycle method of operation was created because it was looked upon as the easiest and most direct mechanically for the compression-type of engine. Its disadvantages were well-known, but it has never been accepted as final. It soon became very evident that for the large powers, particularly for marine propulsion, the two-cycle method offered the best solution. Indeed, it has always been well known and has never been disputed that the mechanical side of the proposition is far more attractive in the two-cycle type with piston controlled ports. Whatever failures there may be on record in the development of the internal-combustion engine in the large units for ship propulsion, the four-cycle has at least an equal share. The main reason for two-cycle failures is found in insufficient scavenging. The high volumetric efficiency of the scavenging idea, as used in the four-cycle, was too quickly accepted and applied in an indirect manner to the two-cycle engine. The movement of air currents in the cylinder during the scavenging period cannot possibly be followed along fixed lines of the designer's imagination, as he lays out an exhaust port on one side of the cylinder and a scavenging port on the opposite side and a baffle-plate piston to direct the flow of incoming air, or when he used a valve in the cylinder-head for the scavenging-air inlet.

"This valve-in-the-head scavenging cannot be accepted as an improvement, either volumetric or mechanical, over the old baffle-plate, in spite of the fact that it is used

Special design of Weiss cylinder liner referred to in the text

in large units of recent design. The port arrangement in the Weiss engine is the logical step in the direction of securing high volumetric efficiency without sacrificing the advantages and simplicity of piston-controlled ports.

"Incidentally, there comes with this method the solution of the piston and cylinder liner problem. The annular arrangement of the ports, which allows a perfect water-jacketing of the liner and cylinder-head, also provides for an equal distribution of metal in both the liner and cylinder-head. As the liner is independent of the water-jacketed portion of the cylinder, its expansion axially is taken care of without any strain in the liner or the cylinder. The strain set up in cylinders cast integral with the jacket, due to temperature differences,

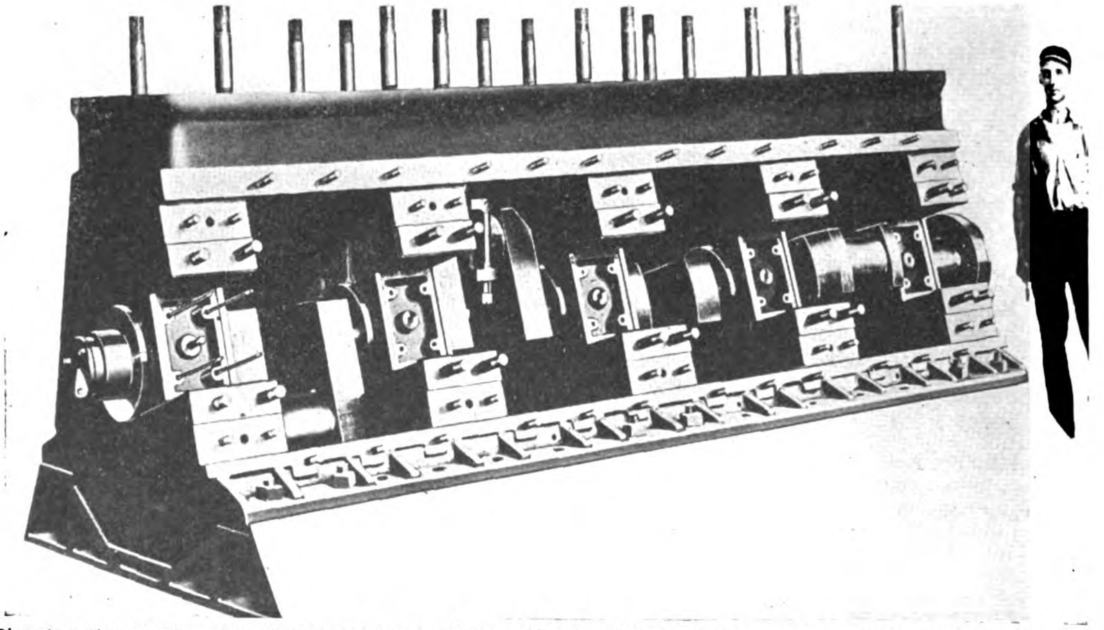
has been the cause of many failures, especially in engines of the larger sizes. Cracks are frequently developing in the port section of the cylinder and jacket in sizes over 9-inch bore even before they leave the foundry.

"The system of scavenging in the Weiss engine, supplying, as it does, a supplementary scavenging-port for the purpose of supplying a greater volume of air than can be effected by the crank-case compression method, still uses the crank-case compression, however, for manipulating at low speeds at which the auxiliary air supply may be at only atmospheric pressure. The crank-case gives a fixed and dependable volume at all speeds of the engine, which is used for starting and manipulating.

"The volume of the auxiliary scavenging-air is supplied by a centrifugal pressure blower driven from the engine shaft direct. There is, therefore, swept through the cylinder a volume of air equal to approximately twice the piston displacement. While it is true that the same high ratio of scavenging air to piston displacement can be had by low pressure piston air compressures, driven from some convenient reciprocating part of the engine through a walking beam, such as is employed in large two-cycle Diesel engines, it should not be overlooked that the complications are very much greater, involving, as it does, a complete scavenging engine of 100 per cent. greater displacement than the main engine.

"With the engine scavenging-pump we are getting further away from the solution of the problem. The two-cycle simplicity cannot be saved by loading it down with the complications of two-cycle scavenging pumps, or step pistons. The single engine with two revolutions to one effective stroke is mechanically a better proposition than two engines with only one effective stroke per revolution, which we really get with the separate piston-pump scavenging idea. The centrifugal pressure blower cannot be duplicated by any other means for large volume, simplicity and reliability.

"Not depending upon ignition by compression and on account of the high volumetric scavenging of the 16½ x 22-inch cylinder at 245 r.p.m. the compression pressure of 200 lbs. per square inch is well within the practical temperature limit. 16½ x 22 cylinder volume minus the port volume is $\frac{214 \times 19 \times 245}{1728} = 576$ cubic feet per minute, and the combustion of 0.703 pounds of oil = 14564 b.t.u. Caloric value 18,6000 b.t.u. per lb. This is approximately 30 b.t.u. per cubic foot of piston displacement. Assuming 80 per cent. net volume (allowing for increase volume due to somewhat higher initial temperature and 10 per cent. exhaust mixture in the charge), we have 37.5 b.t.u. per cubic foot and expansion ratio of 7. The temperature is therefore very low, considering that as high as 60 b.t.u. per cubic foot are successfully used in large gas engines."



Showing the construction of the crankcase of the 400 b.h.p. Weiss marine engine and how the bearings and crankshaft can be removed from the front of the engine

While we gladly give publicity to the views of the designer of the Weiss engine over the two-cycle versus four-cycle question and other features of engine design, as just expressed above, we do not necessarily agree with all or any of his views, especially if the same applies to marine oil-engines in general. At the same time Mr. Weiss has expressed his ideas in a most clear and logical manner, and the same are based on his own experiences extending over many years, so what he says cannot idly be disregarded although they may be disputed. Doubtless other oil-engine builders will be able to present the case from their own aspect, and the use of our columns is extended to them for that purpose.

JAPANESE WOODEN MOTORSHIP

A wooden motorship of 850 tons gross (about 1,300 tons d.w.c.) has been launched at the Nagasaki yard of the Mitsui Zosen Kaisha, Japan.

WELL-KNOWN NAVAL ARCHITECT GOES TO FRANCE

Mr. J. Murray Watts, the Philadelphian naval architect, has been commissioned a captain in the 57th Engineers (Inland Waterways) U. S. Army, and will have left for France by the time this appears in print. While he is in the service of the Government Mr. Watts' business will be handled by Cornell & Matthews, Naval Architects and Engineers, 712 Bulletin Building, Juniper and Filbert Streets, Philadelphia, Pa.

Capt. J. Murray Watts

GERMAN MYSTERY SHIP

Even Germany appears to have a "Hush! Hush!" warship. This is the "Graf Spee," built at the Schichau yard, Danzig, and launched a year ago last month. She is of very high speed and great gun power. The new German light cruisers, "Mannheim" and "Koln," are of 6,300 tons displacement and 33 knots speed, and were built at Krupps Germania Yard, Kiel-Garden. Oil fuel for 12,000 miles is carried. Their length is 520′ by 49′ beam and 17½′ depth, the armored belt being 320′ long. Obviously the "Mannheim" and "Koln" are the largest and most powerful light cruisers yet built by any nation, and in view of our editorial leader in the June issue, are of special interest. They carry two 8.2″ and six 5.9″ guns and four torpedo-tubes.

AEROPLANES AND ENEMY SUBMARINES

Once or twice we have hinted that aeroplanes are not so effective as a fighting machine against submarines as some of the daily newspapers have endeavored to make the public believe, and that in our view the same amount of money could more effectively be spent on sea-going motor-driven destroyers. This theory is supported by recently published French figures. During July the French maritime-aerial patrols covered 485,330 miles, or a total of 14,193 hours aloft. Yet enemy submarines only were attacked 14 times (the actual number of U-boats sunk were not given). Over half of the "flying hours" were made by aeroplanes and seaplanes, and the rest by captive and dirigible balloons.

A submarine is a most difficult target to hit from above, unless the aeroplane can swoop down close to her deck. It may be remembered that out of over 600 bombs dropped on the "Goben" by allied airmen only few hits were registered, and a battleship is a larger target than a submarine. Also the many air raids over London have shown how difficult it is to hit a definite object, although, of course, air-craft are highly valuable for scouting for submarines near the coast, and so should be built in large numbers. But, when used out at sea off a mother-ship their number is very limited, apart from the liability of the mother-ship herself being torpedoed.

NEW DANISH 7,000-TON DIESEL MOTORSHIPS

Several steel vessels of 7,000 tons loaded displacement are to be fitted with Holeby-Diesel heavy-oil engines of 1,600 b.h.p. in twin-screw sets to the order of the East Asiatic Company of Copenhagen. The Holeby-Diesel Engine Works, Holeby, Lolland, Denmark, now are owned by the new Danish Diesel Motor Company, who control five ship-yards and who have very strong financial and shipping backing. We referred to the latter project in a recent issue.

THE JACOBSON OIL-ENGINED HOIST

We have received from the Jacobson Oil Engine Company of Saratoga Springs, New York, details of their new design of heavy-oil engined hoist and no doubt particulars will interest shipowners and dock owners. These hoists are designed for use wherever a compact hoisting outfit is required, and they are built in any size and with either horizontal or vertical engines. The engines are of the latest Jacobson design with quick-starting ignition-heads and torches. The fuel-injection system has been refined and is more economical with fuel than ever before. The manufacturers believe their governing system to be unusually simple. This governor allows the load to be hoisted at the speed desired by the operator and prevents racing when the load is released. The hoist itself is made with either single or double drums and swinging gear and with or without cat-heads. Clutches and brakes are fitted with hard wood linings. Controls are centralized and are easily handled by one man. All bearings in both hoist and engine are of generous size and well lubricated. The engine is connected to the hoist by either cut-gears or by silent-chain drive. The whole unit is mounted compactly on structural steel frames, or cast brass, which are very light, and still offer the required rigidity. Attention is drawn to the fact that this special winch and hoist can be made practically for any size of a redge. Also for hoisting large weights in ship yards and can be mounted on portable cranes such as operate the standard rails in heavy excavating and general contracting work. In other words, this oil-engine and combination of machinery is designed to be used where steam plants have been required before.

Our Readers' Opinions

(The publication of letters does not necessarily imply Editorial endorsement of opinions expressed.)

A GOVERNMENT OFFICIAL'S VIEW

To the Editor of "Motorship":

Sir—I am particularly interested in the development of the Diesel-type engine, as I feel that this type of engine undoubtedly will solve a great many of our present problems, and personally can see no reason why its development should not be more rapid than it has been.

Enclosed please find my check covering subscription to "Motorship" until August, 1919.

Yours very truly,
STEPHEN BOURNE,
Secretary U. S. Shipping Board, Emergency Fleet Corporation, Philadelphia, Pa.

MORE U. S. CONCRETE MOTORSHIPS

To the Editor of "Motorship":

Sir—We believe that in the future the majority of reinforced-concrete vesesls will be equipped with oil-engines of the Diesel or "Semi-Diesel" types. In all the tankers on which we are figuring motors will be used. Yours very truly,

INTERNATIONAL CONSTRUCTORS.
Per T. Ahlborn.
64 W. Randolph Street, Chicago, Ill.

An Appreciation of "Motorship"

To the Editor of "Motorship":

Sir—I have just received the August number of "Motorship" and read same carefully and with great interest. I might add that of the many publications I receive, "Motorship" is the only one I read from cover-to-cover. The paper is doing a great work; it interests and encourages those who for years have believed in Diesel engines; it interests and makes "doubting Thomases" sit up and think—in time they will be convinced!

I was also pleased with the new feature—the illustrated patent record. I have known Mr. Schreck intimately for the past eighteen months, both professionally and personally. I feel sure he will make a success of this department, which is really a valuable addition to "Motorship."

Yours very truly,
L. B. JACKSON.
The Texas Steamship Company
Construction Department, Bath, Maine.

ANOTHER APPRECIATION

To the Editor of "Motorship."

Sir:—I am seizing this opportunity to tell you of the great delight I experienced in reading your August issue of "Motorship." I don't see how anyone reading this issue very carefully, no matter how pessimistic on motorships before reading, can be anything but a supporter of motor-vessels after such reading. Yours very truly,

(Signed) JOHN H. BERNHARD.
Transportation Engineer,
New York City.

THE OTTO-CYCLE OIL ENGINE

To the Editor of "Motorship"—

Sir: (1) Prof. Lucke's articles are highly interesting as regards improvements in combustion and construction, and we are working precisely along the lines he has laid down, except in the matter of controlling and utilizing the heat generated in the cylinders.

(2) It is obvious that ignition devices, which will not be practical or durable in operation with Prof. Lucke's system if the cylinders are cooled in the ordinary manner, will be both practical and durable when working in a cylinder which is internally cooled.

(3) The effectiveness of cooling the cylinders and pistons by injection of water and generation of superheated steam after combustion, has proved so satisfactory that we have concentrated our more recent efforts in perfecting simple devices for control of the injection of water.

(4) On page 6 of your August issue there is a statement confirming the well-known "real cause of unreliability, the heat stresses set up in the castings." The same article also refers to the "great quantity of heat which must be transferred through the cylinder walls of a high-speed Diesel engine."

(5) There is no more necessity for adhering to the old water-jacket cooling system than there is for adhering to the old steam boiler as a heat-absorber, and when the mixed gases and superheated steam are maintained at safe working temperatures for all parts of the cylinder, the numerous construction, ignition and cylinder-lubrication troubles are eliminated from the combination. The quantity of water required is nearly as great as the quantity of water evaporated by a boiler, per pound of oil burned, resulting in obtaining the practical operating features of a steam engine, without the use of boilers, steampiping and stacks.

(6) The loss of a few points in efficiency would be justified, if reliability and freedom from construction and heat troubles, to say nothing of increasing cylinder sizes, can be obtained. The injection of hot water is as simple as the injection of oil.

(7) We believe in cast-steel cylinder barrels, fitted with removable cast-iron liners, the liners held in place by clamping the flange of the liner between the steel flanges of the cylinder and cylinder head. The easy renewal of liners removes one objection advanced by skeptics, who claim corrosion will result from the use of salt water for injection. The other objection received from the same critics refers to the accumulation of sediment in the exhaust pipe. We anticipate less difficulty in providing for this than is now experienced in blowing soot and cleaning scale from boiler surfaces.

(8) Development of an internally-cooled, moderate-compression oil engine operating on the Otto-cycle will be somewhat delayed, due to difficulty in financing at a time when investment in government war issues has a decided preference.

(9) We are prepared to co-operate and to make favorable arrangements with an enterprising and reliable manufacturer in position to undertake production of oil engines.

Yours very truly,
INTERNAL COMBUSTION STEAM ENGINE CO.
By PAUL C. MULLIGAN, President.
21 Coleman Dock, Seattle, Wash.

SAILING-SHIPS AND CALM WEATHER

To the Editor of "Motorship":

Sir:—I read with much interest the various articles in your September issue on the advantages of the auxiliary ship, but it seems to me that none of the writers has put enough stress on the fact that an auxiliary oil-engine puts the sailing-vessel in a position to escape from a zone of absolute calm. I remember that about fifteen years ago, just before the large sailing-vessels were laid up by the scores, much activity was developed in drawing up charts of economy from actual sailing-vessel records, illustrating how they sometimes lost weeks by lying in such a calm, whereas only a few hundred miles away was blowing at the same time a strong and favorable breeze. This condition was one of the strong points which made the competition of the sailing-vessel impossible and the life aboard for the crew intolerable. This economic difficulty, once of so great importance, has been removed by the auxiliary motor-equipped sailing-vessel. Yours very truly,

New York City. H. SCHRECK.

RANDOM REMARKS ON MODERN MARINE DIESEL ENGINES

To the Editor of "Motorship":

Sir:—With reference to Mr. H. R. Setz's article on the above subject in your last issue I would like to make a few comments:

First, it would be quite of interest to learn which authority, builders or buyers, in this country has laid down so distinct rules about the bore to stroke ratio that we could pronounce the claim in one direction or the other as a fallacy? At any rate not theoretical discussions are to solve this question, but actual results.

Secondly, the predictions of Mr. Setz that long-stroke marine engines are neither popular today nor are they likely to become so, may be—to say the least—doubted, if one considers that there have been bought in this country more licenses for building this Diesel engine criticized by Mr. Setz, than all the licenses acquired in all the European countries of all the other marine Diesel-engine makes taken together

Thirdly, that in regard to the compression it may be recalled that the general tendency is to keep this pressure as low as possible and only just high enough to insure ignition of the fuel in a cold engine. This seems to be attained on the criticized engine by proper fuel-injection and atomization, since they have never failed in this respect in marine service—generally—one cannot hide such a failure as to its effect on the ship.

Fourthly, it may be mentioned, although only the four-cycle marine engine has been referred to, that the leading two-cycle engine builders have also given the preference to a long-stroke engine, such as Carels Freres, of Ghent, Belgium, who uses a bore to stroke ratio of 1,8,; Krupp, of Kiel, Germany, who adopted a ratio of 1,83, and if Sulzer Bros., of Winterthur, Switzerland, employ a shorter stroke they have their reason in their method of scavenging, on which engine a long stroke would keep the burnt gases entrapped in the upper part of the cylinder.

Fifthly, that contributor takes advantage of this particular bore to stroke ratio for his argument of a proportion as assumed by him from a few engines, but, on the other hand, it must be concluded that the criticized ratio has evidently never offered any trouble or proven to be ineconomical as, otherwise, a progressive company as the one in question would have altered this on later types of their engine. Those few difficulties which have occurred may be traced to marine requirements, such as every builder of stationary engines has found out and every novice in the marine line. However these "bound-to-come" experiences have in most cases nothing to do with the Diesel part of the engine; but they are mechanical problems which the marine engine involves, no matter, whether steam or Diesel. Yours very truly,

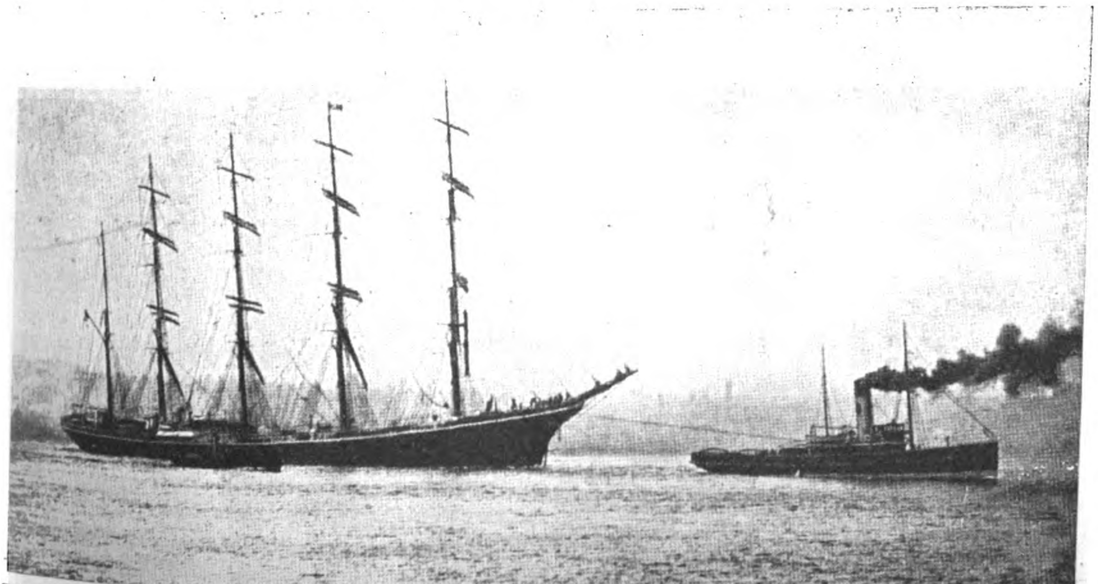
Somewhere in America. DIESEL ENGINEER.

MORE APPRECIATION OF "MOTORSHIP'S" WORK

To the Editor of "Motorship":

Sir: We take this opportunity to thank you for the services rendered by you to the motorship business in general, especially to the Diesel engine itself. We also thank you on behalf of our home office and sincerely hope that the efforts of "Motorship" may truly be appreciated by shipowners and authorities to their full merits. We are pleased to double the amount of advertising carried with you. Yours very truly,

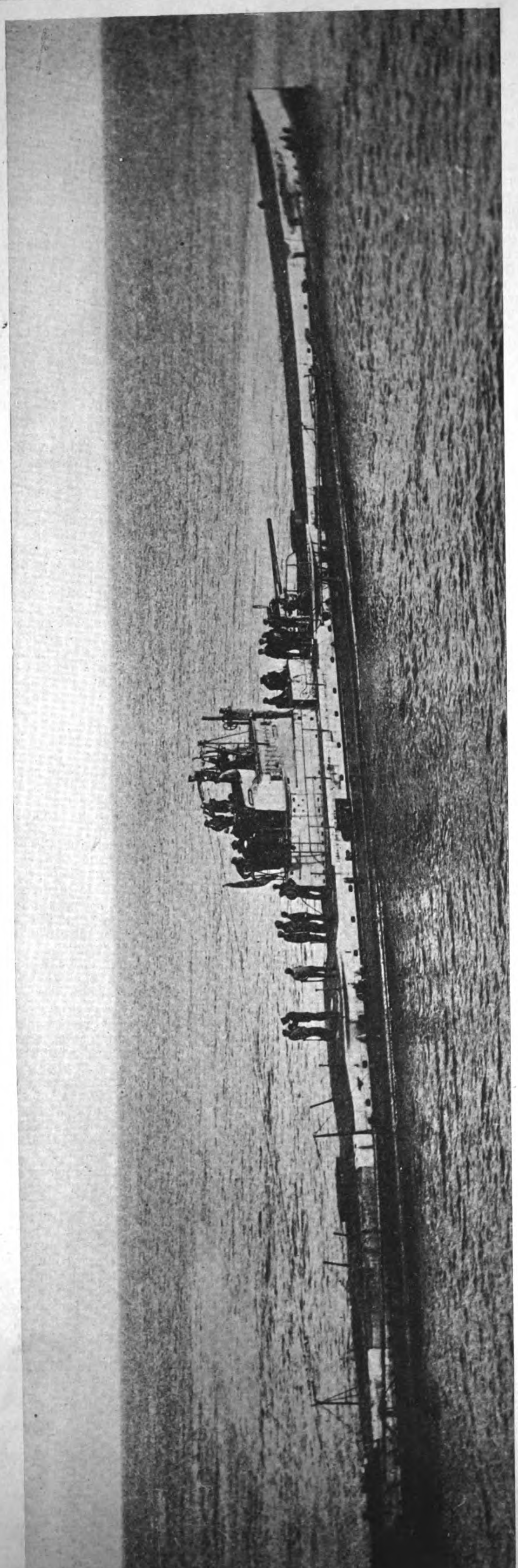
FRANCO TOSI COMPANY,
New York City. Per C. E. Spinnler.



TOWING SAILING-SHIPS.—This extensive waste of labor, coal, fuel, and tugs, daily occurs along the East and West coasts and harbors of the United States. Every sailing-ship should be at once equipped with the maximum suitable auxiliary internal-combustion-engine power. Auxiliary power also will about double the annual carrying capacity of sailing-ships—a very vital matter in these days of Ships, Ships and Ships!

One of Germany's Despicable Destroyers of Merchant-Ships

It Is the Heavy-Oil Engine That Made the Submarine Warfare Possible and It Is the Heavy-Oil Engine That Will Enable the Submarines to be Defeated



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A German U-boat in the North Sea. She appears to be of about 1,000 tons displacement and carries a 5.9" gun. Details are given on the next page.

RECENT SUBMARINE SINKINGS

A Practical Review of the Present Situation

While the greatly reduced number of merchant ships sunk of late compared with those of nearly a year ago clearly show that the Allied navies positively are getting the German submarines well in hand, it is our humble opinion that, despite official announcements, the position, while getting better every month, has not yet been reached where the U-boats merely remain an annoying pest, but, that the underseas warfare still is a serious factor to contend with, and that in consequence there must not be the slightest let-up in the rush of construction of merchant vessels, destroyers, and large sea-going chasers. There is too much danger for us in over-confidence!

According to the British Admiralty announcement of August the total Allied and neutral sinkings for July amounted to 303,011 gross tons. This is approximately 500,000 tons dead-weight-capacity and it is to the latter class of tonnage that American construction figures are given, so we may as well ignore the gross tonnage, which anyway is misleading.

Now let us endeavor to review the situation in a calm and practical manner and without hysterically jumping to hasty conclusions. Compared with the submarine sinkings of some months ago (except April) the July figures are quite low. Yet, if Germany manages to maintain this rate, namely an average of 500,000 tons d.w.c. per month, it means 6,000,000 tons d.w.c. a year. This is no mean amount, especially as every freight-laden ship sunk on her eastward voyage means months of tedious labor totally wasted, not only in the construction of the ship herself but in the production of her valuable cargo, also delay in putting a certain number of men and guns on the battle line until the supplies lost can be replaced. Thus every ship sunk means so many days longer before victory is won and peace declared.

America has on hand a larger merchant ship construction programme than any other nation, but it is unlikely that much more than a total tonnage of 3,500,000 tons d.w.c. will be fully completed during this year, which means that our Allies and neutrals must between them turn out at least 2,500,000 tons d.w.c. before December 1st purely in order to equal the average of July sinkings. However, as a matter of fact, the ship losses for the six months previous to July were higher than the 500,000 tons d.w.c., so, unless America, her Allies and neutrals, together, build and place in service a total of 7,000,000 tons d.w.c. between January 1, 1918, and December 31, 1918, the submarine, mine and ordinary marine casualties will exceed new production. During August last America and Great Britain, together, built 474,675 tons, of which America was responsible for 340,000 tons alone.

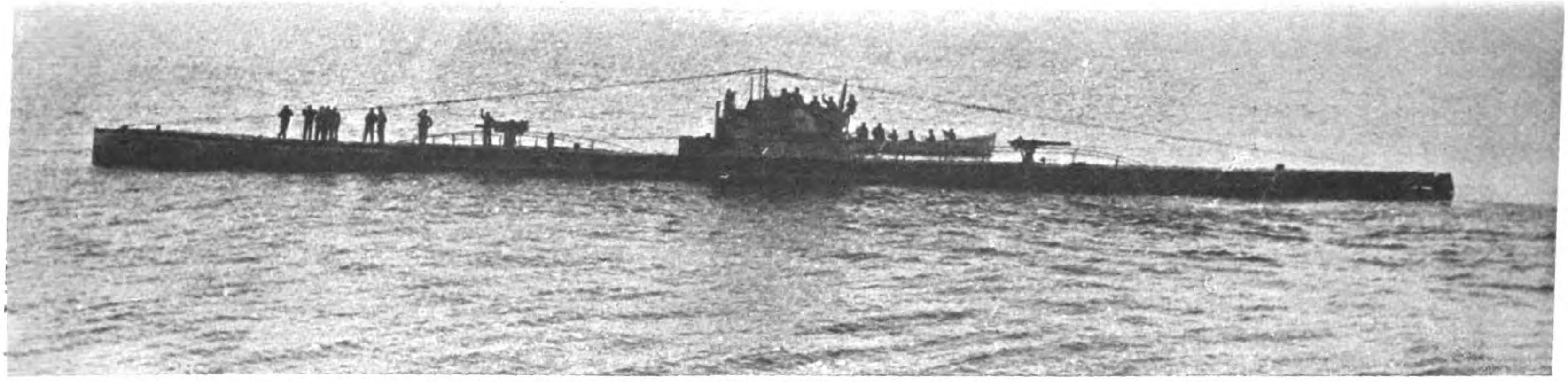
At the same time we should make it clearly understood that Germany will have to average double or treble the July sinkings if she is to stand any chance of being able to dictate any of the terms of peace, especially as the United States alone will complete about 9,000,000 tons d.w.c. of merchant ships during the next year. On the other hand, we must not overlook the fact that the recent bottling-up of Zeebrugge and Ostend must have partially accounted for the reduction of the number of merchant ships sunk, and many U-boats were held up in those harbors. If the Germans manage to clear the harbor entrances, it will mean that the bottled-up U-boats will be out on the rampage again and increase the sinkings of ships.

Consequently, if strikes or other factors prevent us building these ships the situation will become very serious, especially as we soon will have 4,000,000 men in France to keep supplied, so the entire United States must become forty-eight States that are united as one man straining might and main and with every ounce of effort to get these ships built. And, because of the low visibility, low fuel consumption and greater cargo capacities of oil-engined vessels, hundreds of our 1919 merchant fleet should be motor-ships.

THE LATEST GERMAN SUBMARINES

During the thirty-odd months' existence of "Motorship," we have endeavored to give instructive and accurate information to our readers regarding German U-boats, and, although we say it ourselves, we do not think we have failed in this particular task, considering the difficulties in the way. We have pointed out that we do not think Germany yet has placed in actual service any submarines larger than 1,500 tons displacement, which, of course, would be craft of considerable size and much bigger than the modern T. B. destroyer, and with heavier armament and plating.

In our June issue we published a photograph of a German submarine of about 1,200 tons displace-



The German submarine U-63. She is described on this page

ment, and on May 11th a U-boat of about this size or perhaps a little larger was sunk by one of the big British Atlantic escort submersibles. This Hun craft that we illustrated had two 5·9" or 6" guns.

We now produce a photograph of a German submarine taken in the Atlantic during August last. This vessel appears to be a little smaller and probably is of 850 tons surface and 1,000 tons submerged displacement, and apparently is of Krupp design, so possibly was built at the Germania yard, Kiel-Gaarden, and fitted with two 1,100 B.H.P. Diesel oil engines of the type that now are fabricated throughout Germany, and erected in one great engineering plant near Kiel. By carefully observing the original photograph through a magnifying glass we notice 29 of her crew on deck, so she probably carries 35 to 40 men, engineers and officers.

Forward of the conning tower there is a 150 mm. (5.9") gun, and aft of the conning tower is a platform for another gun of the same size, while aft of the hatchway over the engine-room is a platform for a smaller gun, and the latter may be of the disappearing type, although we doubt it because of its then being in the way of the machinery below. So either this U-boat was found too small to carry three guns, or else at some time she transferred two guns to a captured ship and so made a raider, as in the case of the trawler "Triumph" off the Atlantic coast recently. Two men on the conning tower can be discerned watching the horizon with binoculars for the smoke of other approaching vessels. The periscopes are telescopic, so are not plainly discernible. Alongside the bow and stern, on the starboard side, are folding masts, while stretching from the conning tower nearly to the stern are the wireless aerials. The hull is so built that even with the conning tower riddled with shot, or even rammed by a surface ship, the submarine still could be navigated both on and underneath the water.

While this is quite a large vessel, she is by no means of the largest class and cannot compare in size to the latest French, Italian, British and Japanese submarines; nor with the large new American-built submarine illustrated in our last issue. Yet to the laymen she may appear to be one of the "submarine-cruisers" so frequently described in the daily press. Our conception of the "submarine-cruisers," however, are the newest U-boats of about 1,500 tons, with three 5.9" guns, for truly such are formidable warships even for a destroyer to attack.

During the war Germany has done quite a little juggling with the numbers of her submarines, with a view to confusing the Allied navies. This is the U-63. According to Jane's "Fighting Ships" the U-63 to U80 were built in 1915-16 and have a submerged displacement of 1,050 to 1,150 tons, with 800 to 850 tons surface displacement. They are about 250′ long and are fitted with two 1,150 b.h.p. Diesel-type oil-engines. The large guns are a 4.1" and a 3.4" and there is one dismountable machine gun. Four 20" torpedo tubes are fitted, eight to eleven torpedos being carried. Speed, 18 knots on surface and 12 knots submerged.

According to the London "Engineer," a new class of submersibles have been built by Germany, which have been specially designed to take part in fleet actions, and are therefore capable of travelling at high speed, besides being extremely easy to manoeuvre. They are named after successful submarine officers such as Weddigen, Hersing, etc. They will be used with the Grand Fleet.

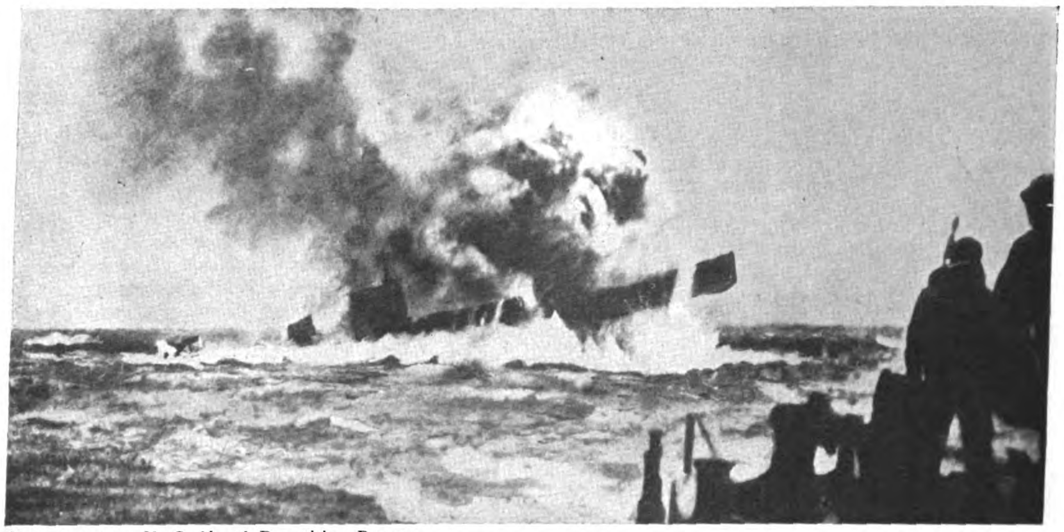


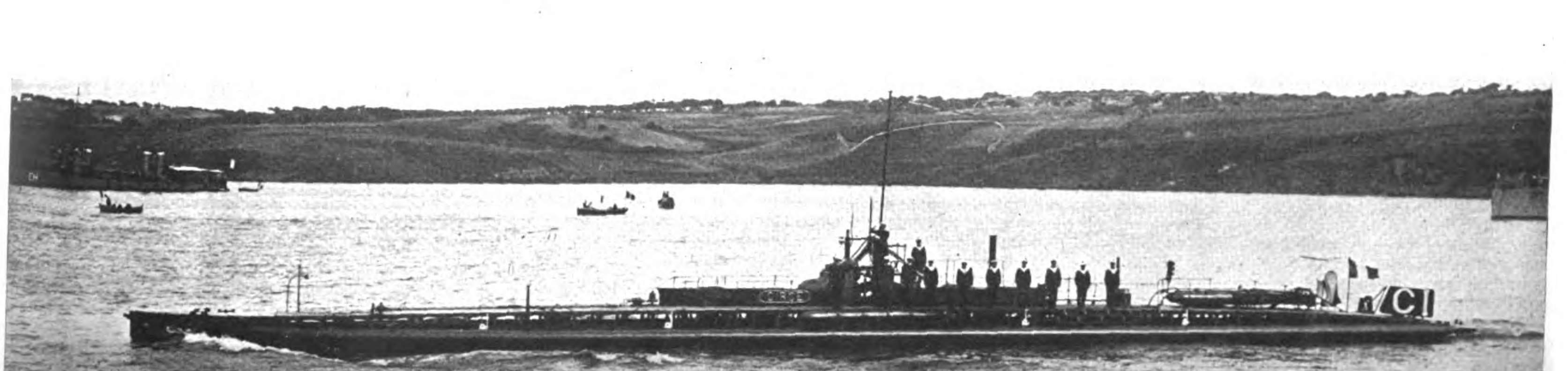
Photo courtesy U. S. Naval Recruiting Bureau.
The power of a depth bomb or the end of a German submarine

THE VALUE OF UPSETTING GERMAN MORALE

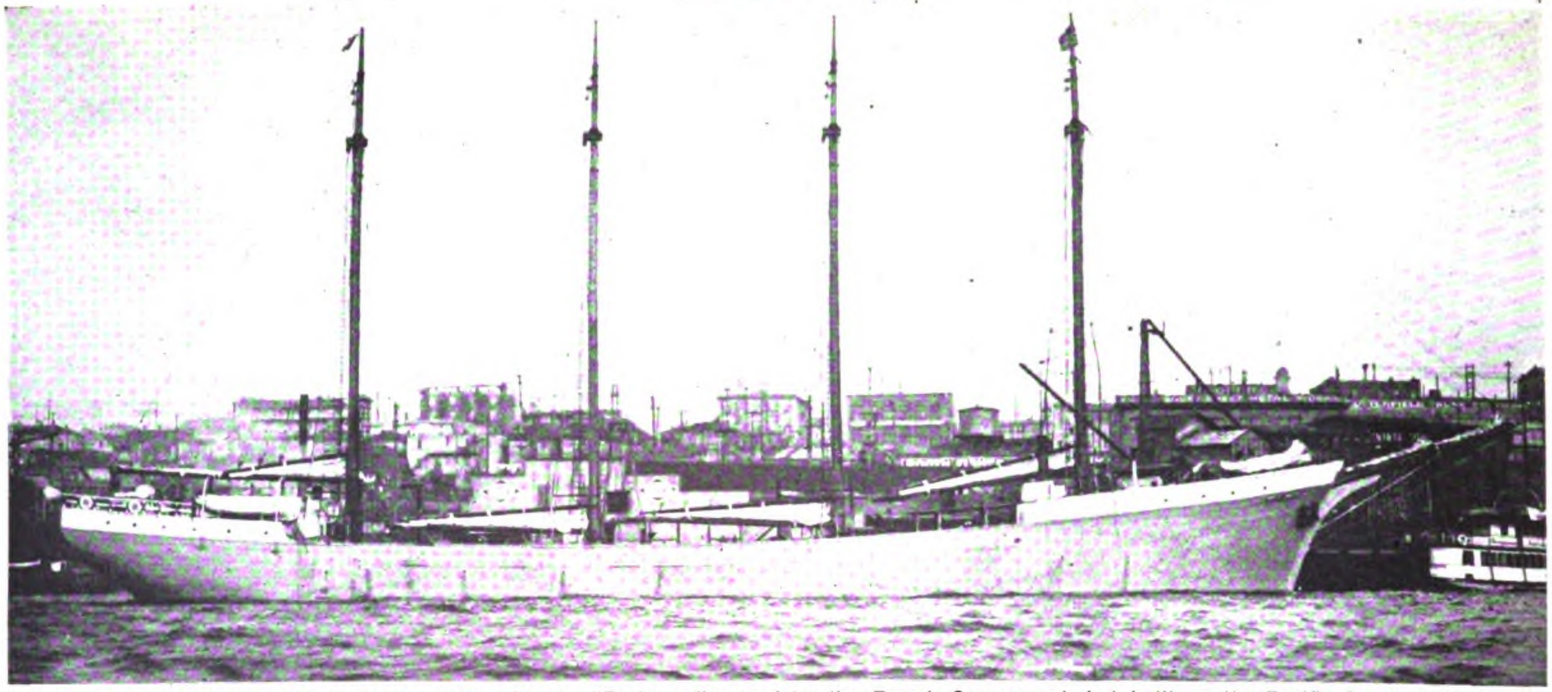
Secretary of the Navy Josephus Daniels recently said: "If the Germans knew the number of new destroyers he had in mind it would carry fear to the heart of Von Tirpitz and the murderers who are making submarine war on the seas." These are our sentiments to the letter, and nothing is better for upsetting German morale than wide publicity concerning things we are doing (not things we hope to do). What could assist America better than huge photographs of the entire American army and navy, if such were possible, and if it were possible to print them in every German newspaper? It would let them see that we are not a nation to be sneered at and tend to make them nervous, and a nervous fighter is a doomed man!

CANADIAN AUXILIARY SHIP

"La Voluntaire," a wooden auxiliary brigantine, has been launched at the shipyard of J. N. Rafuse & Son, Shelburne, Canada. A 100 H.P. motor is fitted.



Official French Photo.—Courtesy of "Sea Power."
The French submarine "Circe." While she is of a very seaworthy type she is much smaller than the "Nereide" class built by Schneider et Cie, which submersibles are of 1,050 tons submerged-displacement and are fitted with two 2,400 b.h.p. Schneider-Diesel engines and have a speed of 20 knots.



The 480 b.h.p. Skandia-engined motor auxiliary schooner "Barleaux," owned by the French Government, but built on the Pacific Coast of the U. S. A.

A Retrospect of the Marine Oil-Engine Situation

By GEO. N. SOMERVILLE

[The author of the following article is the Chief-Engineer of the Skandia Pacific Oil Engine Company, of San Francisco, Cal., who are building both Diesel and Surface-Ignition types of Marine Oil-Engines, including 20 high-powered Diesels for the U. S. Government, and partly for that reason it will be found of value and interest to both shipowners and engineers.—THE EDITOR.]

THAT the internal combustion heavy-oil engine has come to stay, is, without a doubt, proven by the large number of installations of this type of marine prime mover within the last two years. It is, of course, impossible to state, at the present stage of development, whether the true Diesel or the hot-surface ignition type engine will prevail. There, no doubt, is a good field for each—which cannot be properly defined until we have had considerably more experience. The true Diesel cycle, no doubt, will be favored, due to its higher fuel economy, which is offset to a considerable extent by its higher initial cost, and the higher grade of operators required.

It must not be assumed, however, that the surface-ignition motor can be run by inexperienced help, as experience within the last few years has plainly demonstrated the necessity for the proper education and training of operators for these engines. The innumerable difficulties which have had to be surmounted, generally can be condensed to three principal elements:

FIRST: Lack of experience on the part of manufacturers in this country.

SECOND: Lack of experience on the part of operators. And

THIRD: Improper manufacture and installation.

There is absolutely no excuse for the last-named source of trouble. The manufacturers are quickly grasping the small details and overcoming them so that the time is not far distant when engine builders in this country will have absorbed a sufficient amount of information and experience to enable them to stand on an equal footing with our European contemporaries.

There still remains for us, however, the vital question of educating our sea-going engineers in the handling of these oil engines, which are fast assuming the position in the maritime world to which they are entitled. It is needless to enumerate the large number of successes and failures, which in a great measure can be credited to either the success or failure of the operators to properly handle the installation. There exists at the present time, a very favorable desire on the part of both steam and gas engineers to assimilate the necessary training and information, which would point to the absolute necessity of some Government or private means of training these men.

We read quite frequently of the successful performance of engines manufactured by long-standing European manufacturers; but, it must be remembered, that these organizations have been manufacturing these engines for the past fifteen to twenty years, and have long since passed through the stage in which we now find ourselves in this country. It is quite true that we have available their experience and laboriously gained information, but it is not always possible for us to know just what we require.

While the engineering fraternity of the United States has developed and perfected to a very high state the gas and gasoline engine of the present day, our European friends have not been so well favored with these fuels, and have necessarily been forced to devote their attention to the development of a motor suitable for use on the heavier grades of semi-refined petroleum. The enormous field in Russia has offered, for a good many years, a very fertile market for the surface-ignition motor, and to meet this demand the present success of the European motor can be attributed.

With the present unusual demand for shipping, heavy-oil engines, both surface-ignition and Diesel types, have been offered a wonderful chance to prove their worth in the marine installations of the present months, and it is gratifying to note the large percentage of successful installations, which prove the ability of American engineers to develop and manufacture this type of motor.

At this point it would probably not be amiss to mention some of the difficulties encountered by some of our manufacturers of these engines.

We hear a great deal in technical papers dealing with such subjects as cracked cylinders, pistons, and cylinder heads. If one remembers back to the early stages of the gas engine, he will, no doubt, recall the same trouble. We are dealing in the Diesel engine with much higher pressures and temperatures, and these vital parts cannot be designed according to the old rule of thumb methods which we have all learned by our years of experience in the gas engine field. It becomes necessary to pay a great deal of attention to considerations of expansion, contraction, and pressure distribution in these members, and it is not infrequent to find well-designed engines running for months—yes, years—of continuous service without the least trouble from cracked castings.

In the surface-ignition engine, conditions are somewhat different than in the Diesel engine. Aside from the usually lower pressures and temperatures, we have in a great many American-made engines of this type, water-cooled or partially water-cooled heads with attached hot surfaces which are maintained at a red heat. To properly allow for expansion and contraction between these widely different temperatures in adjoining members, requires considerable skill and experience, and unless the manufacturer is prepared to devote the necessary time to this consideration, failure is sure to result.

Another cause of considerable cylinder head cracks on this type of engine, has been due to the failure of the operators to keep the cylinder-head circulating water flowing while the hot surface is brought to its operating heat by the torches. The writer has known of a number of instances where motors infamous for their number of cracked cylinder-heads, have been supplied with an independently-driven small pump to keep the water circulating through the cylinder-heads during the starting-up period, resulting in the entire elimination of cracked heads.

Another consideration which demands considerable attention in the manufacture of parts for these heavy-oil engines, is the foundry mixtures. Because of the necessarily complicated construction and intricate core work required in the cylinders, cylinder-heads, pistons, etc., foundry mixtures must be such as to give good flowing qualities to the iron, with the requisite strength and flexibility. The foundry question, however, is not anything new; it simply requires a close watch by the foundry men to find and then maintain the proper mixtures. It does not present anything new or difficult, provided the proper attention is given or a little experimenting done in the beginning of the manufacturing period.

We have heard quite a little adverse comment on the hot bearing situation applied to the surface-ignition and Diesel type engines, and it would seem that this trouble has developed because of the application of long standing steam engineering formulas to the designing of marine oil-engines, something, of course, that cannot be followed. Too much stress cannot be laid upon the necessity of experimentation in the design and operation of this newer type of prime mover. The hot bearing situation now resolves itself into a case of close study on lubrication, together with investigation into the matter of bearing cooling. The writer believes it just as necessary to cool the main-bearings of these large internal-combustion motors as it is to cool the cylinder walls. It has been repeatedly proven that main-bearing troubles can be eliminated, or at least reduced to a very small fraction of their present proportions.

Up until a few years ago, crankshaft breakage occupied a very prominent position in the list of faults cited against the internal-combustion motor, but with the adoption of formulas by the leading inspection societies for the calculations of crankshafts, this trouble has been reduced. [And eliminated where the installation has properly been carried out.—Editor.]

The writer recalls having seen ships' logs wherein a fuel economy in the neighborhood of 0.30 of a pound of oil-fuel per indicated-horse-power hour has been maintained for continuous voyages of from thirty to forty-five days, and this tends to disprove the statement frequently made, that Diesel engines do not maintain their high economy as developed on original installation. The engines in question were 1,600 h.p. units by a prominent manufacturer of Copenhagen, and had been in operation for a number of years.

On the surface-ignition engines fuel economy of 0.5 of a pound per brake-horse-power hour have been noted and maintained over sufficiently long periods to warrant the statement that they, too, will maintain their economical fuel consumption. The fuel economy is, in a great measure, in the hands of the operators, and here again is a point forcibly showing the necessity of the proper training, not only from a mechanical standpoint; but, also on the fundamental principles of atomization and combustion, so that the engineers may be properly fitted to obtain continued success. It has been found that proper atomization is absolutely necessary in any oil-burning engine to obtain complete combustion and only with complete combustion is the high fuel economy obtained.

In the Diesel engine atomization is obtained by means of an air blast with wonderful success. In the surface-ignition engine, both air atomization and mechanical spraying are resorted to, with the preference, probably, a little favorable to mechanical spraying. Governing is now universally accomplished by means of varying the amount of fuel-oil introduced into the cylinder per working stroke, and therefore is closely affiliated with the fuel-pump and fuel atomizing mechanism, and it becomes very necessary for a proper consideration of all these functions in designing and developing a successful engine.

One of the important things to be learned by all operators of internal-combustion engines is the fact that they will not stand the continuous overload capacity that we are in the habit of forcing upon our steam engines. This is easily proven when one stops to consider the effect of overloading an internal-combustion motor. Increased load requires an increase of fuel consumption per stroke, and with a given compression an increase of fuel-oil immediately introduces higher temperatures and pressures of combustion, the result being abnormal temperatures with resulting trouble.

Steam engines, on the other hand, when overloaded, simply require a longer admission of steam at a constant pressure and temperature, resulting in no serious harmful effect for continued operation. [Continually overloading the boiler, however, results in harmful effects, the engine itself merely being the transmitter of the power produced by the boiler.—Editor.] While it is not to be assumed that the internal-combustion motor is not capable of standing overloads, the point that the writer wishes to make is, that continued overloads are to be avoided, rather than made a practice.

Both Diesel and hot-surface-ignition engines must be designed to operate on a wide range of fuels, and present progress along these lines is quite satisfactory. California fuel-oils, while well adapted to consumption in both types of engines, are not always obtainable, and especially so under present conditions, in ports of the Orient and South America. For this reason manufacturers are giving careful consideration to different fuels so as to enable ships' engines to operate on whatever fuel is available. When changing fuel, slight changes are sometimes required in the timing of the fuel-injection, and here again is a good reason why the operator should be equipped with a certain amount of theoretical training to enable him to make the proper adjustments.

To a great many people lubrication has presented a most difficult problem in the engines under discussion, and yet in analyzing the lubricating situation it is very simple. It requires a lubricating-oil adapted to the conditions of operation. For instance, we find high temperatures on the cylinder walls of internal-combustion engines which have a tendency to thin down any grade of lubricating-oil. Therefore a lubricating-oil of sufficient body has to be used so that it still retains a sufficient amount of lubricating qualities under the temperature of operation to properly lubricate the various bearings and lubricating surface within the motor. The bearings which have caused worry on this point are of the crank-pins, piston-pins and main-bearings, and yet a number of manufacturers of these engines are experiencing absolutely no trouble on these points, simply because a proper lubricating-oil is used. Main-bearings and crank-pin bearings have caused some trouble in large crank case-compression engines, and for this reason present-day manufacturers are turning to the open crank-case construction on cylinders above sixteen inches in diameter. Below sixteen inches, experience has proven crank-case compression to be quite feasible and to offer no serious obstacles in the way of lubrication.

There is no question but that we are on the eve of a great manufacturing era of internal-combustion engines, and there is no reason why they should not be accepted today for what they are worth. We know they have proven successful in many cases, and there is no reason why failures could not be turned into successes with the proper analysis and remedy of their troubles.

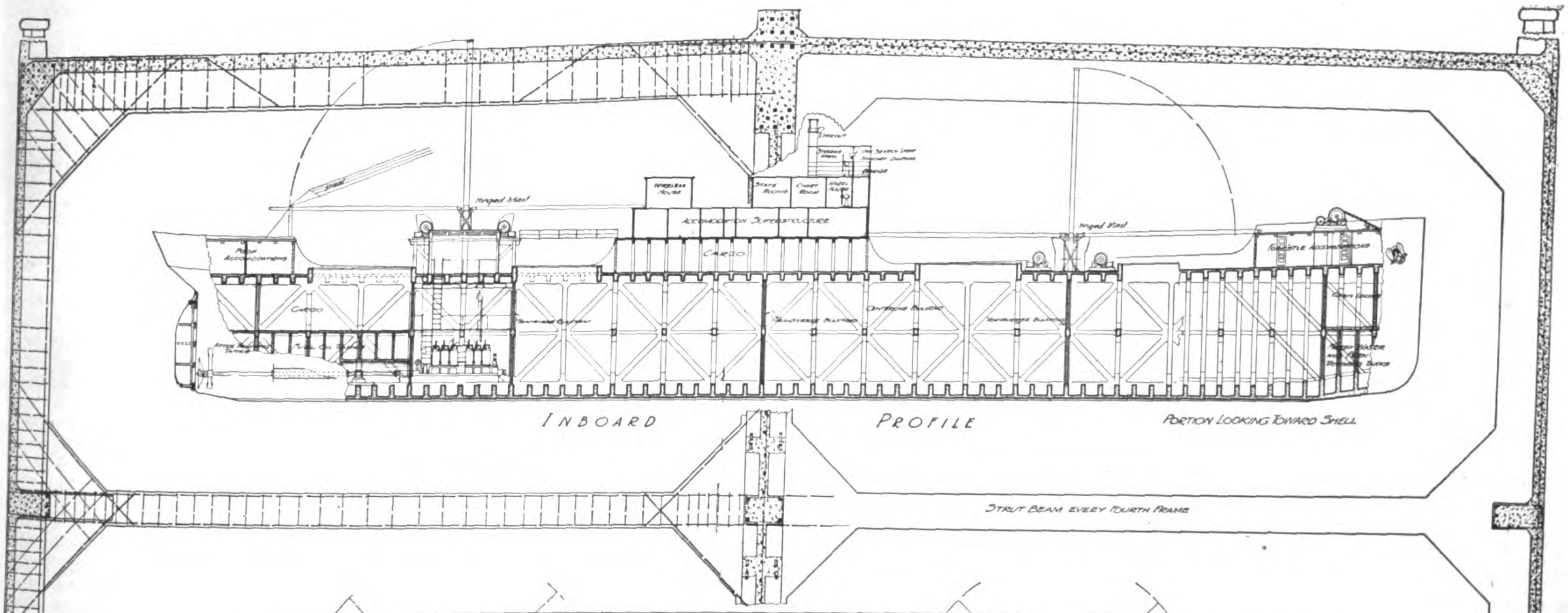
An "Unsinkable" Ferro-Concrete Motorship

By K. H. SCHEEL, N. A.

THE word "Unsinkable" in shipbuilding has been misused by so many marine writers in the past few years, that it is necessary to use quotation marks in this title; the writer therefore defines it as a ship which is designed to greatly decrease the danger of sinking when hull is damaged, but not absolute immunity from sinking, that would be an economic impossibility.

The accompanying drawing is a rough outline of a Diesel-engined motorship of 4,070 tons d.w. transverse scantling system of frames with 5-ft. centers. This ship is being designed for lightness and strength as well as minimizing the danger of sinking. There is a longitudinal bulkhead running down the center line which is designed to aid resistance of hogging and sagging, as well as to increase the number of compartments. There are five main transverse bulkheads and a hatch on each side of center line for each compartment. These hatches are of special design and are clamped and hermetically sealed with a composition gasket against hatch combing. The cargo vents are designed with a special check valve which can be operated instantaneously from central stations located on vital points about the ship, thus in a moment of disaster, each cargo compartment is air-tight.

An air line is connected from the compressor (which is located with other auxiliary machinery



over the engine-room on the main deck), to each cargo compartment, the flooded compartment is then ascertained and if damaged below waterline the inrush of water will naturally compress the air in compartment until the water will be resisted, but by forcing additional compressed air into the compartment, it will in most cases have a tendency to eject the water to some extent and assist in the water-pumping operation.

The principal dimensions of the ship are as follows:

Length O. A.	300' 0"
Length B. P.	290' 0"
Beam	46' 0"
Molded Depth	30' 6"
Dead-Weight Capacity	4,070 tons
Displacement (Loaded)	7,350 tons

An estimate has been prepared giving data regarding the cost, weights and time for construction, as follows: The weight of the ship complete without cargo is about 3,280 tons.

The cost based on being built on Pacific Coast of the U. S. A. is about $127.00 per d.w. ton complete.

The design calls for a twin set of 700 b.h.p. Diesel-type engines, making a total of 1,400 shaft h.p. for the ship. Engines are located abaft amidships.

Assuming that skin friction will be reduced by the glass-like surface of the concrete shell giving a smoother surface than a steel ship, thus lessening resistance, the computations show that this ship will give a loaded speed of approximately 10 knots. The shape of the hull is on regular-ship lines. This is considered no more expensive than the straight line section.

FORMS

A special design for sectional forms has been prepared which will tend to make form work a simple matter. The lines will be laid down on the loft floor in the same manner as for a wood ship, and templets will be made and 4-inch wide flitch frames sawed with the proper bevel on one edge only, then all frames will be erected and planked with 2¼-inch T. and G. flooring, and treated with paraffine or other material. Then a saw cut will be made at every 20 feet, making 20-foot independent sections for the entire length of ship. Each section is built on transverse sleepers, which will act as sliding ways for the forms when hull will have had its thirty days set. Then beginning amidships each section will be removed by sliding forms in an outboard direction. As each form is removed, the bare hull will be blocked up until the entire hull is stripped and blocked up, then the ship's sliding ways can be placed on launching ways and launched in usual manner.

The inside forms are somewhat more complicated, there being a wood form at each frame, with strips nailed parallel to the girth of frames. These strips will be 24 inches long, bent to the curvature of the frame and 3 inches inside the inner surface of shell slab. There will be 6 inches interval between each strip, then as concrete is poured beginning at keelsons, 3-inch boards will be slipped behind strips as the concrete pouring level is raised. These boards can readily be vibrated, and the pouring operation can be carefully carried out as the reinforcement is always in sight.

LAUNCHING

Most of the firms who are planning on building concrete ships are very timid about end launchings, and are designing their ways for side launching, evidently for no other reason than because the "Faith" and a few other concrete vessels were launched broadside, whereas there is only one reasonable excuse for side launching, that is, a narrow launching channel. Side launching requires much more water frontage, four ordinary ships can be built for end launching on the same amount of water frontage that it would take for one ship building for side launch. Why this extra expense, when it is a very simple matter to plot a launching curve and calculations which will give the exact stresses developed in launching which will be far from excessive if the ways are properly laid out.

Motorship Notes from Great Britain

ANOTHER USE OF MOTOR POWER

In connection with the salvaging of merchant and naval ships sunk by mine or submarine, the British Admiralty has found the marine internal-combustion motor to be of the greatest value. Some of the motor-driven pumps used for salvage work have a capacity of 800 tons an hour.

NEW LARGE BRITISH MOTORSHIP BUILDING YARD

A report reaches us from reliable sources that a big motorship building company is to be established in Great Britain. This concern is known as the Union Ship Engineering Company, Ltd., and are laying down 16 slipways for 300 ft. motorships. They also will construct the Diesel oil-engines for these vessels. Lord Pirrie's belief in internal-combustion-engined motor-vessels has shown itself in many practical ways, as is well known, and his wide interests both in shipbuilding and shipowning circles will have an important effect on motorship progress. Lord Pirrie, of course, is the Controller of all British merchant shipbuilding and such a yard could not be started without his approval.

AFRAID TO ACT!

In view of the fact that we are facing a labor shortage in ship operation, and the heavy oil engine ship can be operated with less men below the deck than any other type of vessel ever produced—except, of course, the small gasoline boat. The war, then, has brought to our attention this heavy oil engine as a possible motive power for the smaller of these new merchant vessels as well as naval vessels, though more merchant than naval. And it is a fact that shipping people are considering this question to-day all over the country, but most of them are afraid to act. They would like to, as near as can be found out by talking to them, but they are afraid to act. The time is not far distant when they will have to act, or lose something by not acting.—"Engineering," London.

THE MOTORSHIPPING SITUATION IN GREAT BRITAIN

"There is certainly no fear on our side of the water," says "Syren & Shipping" of London, "of taking the risk of substituting Diesels for steam engines, whatever the case may have been at one time. We are in probably as close touch with owners as anybody in the United Kingdom, and the impression left on us by our conversations with representative men is that British owners have outlived their fears of, and prejudices against, oil engines. They are convinced that the Diesel is suitable for cargo vesels, and that its economy, taken all over, is pronounced. The majority of them may be still shy of new engines—of engines, that is, which have not been proved in the rough and tumble of sea work—but none of them appears to have the least doubt that the best motors of the type are as reliable as the reciprocating steam engine, upon which the pre-war pre-eminence of the British Mercantile Marine was built up. When the times suit they will, we may be sure, order Diesel ships heavily."

"We have never had any doubt about the future of the United Kingdom's Diesel industry, although some of our friends have been much less optimistic. We hope, however, that when next they descend into the depths of their pessimism they will refrain from seeking excuse for their lapse in the British shipowner's lack of enterprise. The British shipowner is now sound on the question of oil-engines. The trouble is very largely the war conditions which prevail. The State is responsible for the programme of new construction which Lord Pirrie is carrying out, so that the people whose flesh ought to be made to creep by Sir Marcus Samuel's tale of motor shipbuilding "on a gigantic scale" in Germany, the United States, Denmark, Holland and Sweden are in or about one or other of the Admiralty buildings and not in the private shipyards and shipping offices. A great many British shipowners and shipbuilders are quite convinced that coal-burning cargo-steamers cannot compete with "ships run on internal combustion engines," and when they are free to do so they will, no doubt, order vessels fitted with machinery of the new type."

THE EDITOR OF "MOTORSHIP AND MOTORBOAT"

Mr. A. P. Chalkley, editor of our British contemporary, has been appointed assistant controller (electrical and mechanical) of the Indian Munition Board, Bombay, India. Until recently Mr. Chalkley was in charge of the British motorboat service in Mesopotamia. Mr. W. B. Horsnaill is the acting editor whilst Mr. Chalkley is working for his Government.

"WHAT IS A POWER VESSEL?"

Shipowners in this country will be interested in the following notice which lately was posted at Lloyd's Registry of Shipping, viz.: "Brokers are informed that the term 'power vessel' shall be deemed to apply exclusively to motor and power vessels which are habitually propelled by their own machinery only. Any vessel which appears both in the steamer and the sailing-ship books of Lloyd's Register or the Bureau Veritas, whether classed therein or not, shall not be included in the above term."

AMERICAN ENGINES FOR BRITISH CANALS

Referring to the possibilities of a market for American oil engines on the canals in the Birmingham (England) district, Consul E. Haldeman Dennison says:

"Motorboats for pleasure purposes are not used in this district, as there is no body of water sufficiently large for such a purpose. There will undoubtedly be an opportunity, however, for the sale of marine engines after the war, provided American manufacturers can successfully compete with those of local manufacture. The field would be confined to engines for canal barges, Birmingham being the center of a network of canals on which many of the boats have already been equipped with motor engines. A great deal of interest is at present being manifested in the development of these canals by widening and deepening them and in modernizing the transport system. Excellent motor engines are made locally and a detachable motor for canal boat haulage is also now being produced and installed on these boats. One large local coal firm has many of its canal boats fitted with a channel bed frame on the top of the cabin to take a 16 to 20 horsepower motor, with a 4-inch bore and 6-inch stroke, dual Kingston carbureter for gasoline or petroleum, and fitted with an engine-starting motor and dynamo. It has been stated that these outfits can be installed on any standard barge in about half an hour.

Since the outbreak of the war the whole canal system of the country has been taken over by the Government. Proposals to improve the canals have recently received a considerable amount of attention. The Government is believed to favor nationalization and a policy of widening and extension to bring the inland waterways up to the same standard of efficiency as those on the Continent. It has been suggested that this scheme be made one of the prominent items in the work of reconstruction immediately after the war. The proposal is that the passage of barges up to 100 tons capacity should be made universally possible."

LUBRICATION OF WERKSPOOR DIESEL ENGINES

In our British contemporary "Motorship and Motorboat" an interesting article on the lubrication of marine Diesel engines in general recently appeared, and in connection with the same Werkspoor of Amsterdam made some interesting remarks, which were published by our contemporary on July 18th last. Because Werkspoor have four constructional licenses in America, we reproduce Werkspoor's comments herewith:

"We should like to draw your attention to the fact that all the principles laid down in this article were already embodied in the Werkspoor Diesel engine of the 'Vulcanus,' which was built in 1910, and was the first full-powered, sea-going motor-ship in the world.

"This engine has trays underneath the cylinders, which close the crankcase entirely. The used cylinder oil and deposit can be drawn off separately and may be used, after filtering, for the lubrication of deck engines. Although the engine was equipped with a forced lubrication system, the cylinders had separate oil pumps, which were supplied with new oil. On most of our later engines we employed sight-feed lubrication, in the first place to comply with the wishes of the engineers, used to this mode of lubrication in steam engines; we returned, however, to forced lubrication for our latest constructions, as it has shown to be quite as reliable as the former system of lubrication, and to have many other advantages.

"The above-mentioned features can be found on every one of our engines, and we fully agree with the opinion of the writer of your article, that the space underneath the cylinders, especially if they are water-cooled, should be separated from the crankcase by oil and water-tight covers. The mixing of oil with sea water may have such disastrous results that the greatest care should be taken not to have any water connections in the crankcase itself, and that all leakage of water into the crankcase is absolutely impossible.

"It may interest you to know that we have actually the engines for seven large motor-ships under construction, the 12 engines of which aggregate about 18,000 I.H.P. The largest of these six-cylinder engines develops 2,000 I.H.P.; the largest of the ships has a displacement of about 7,000 tons."

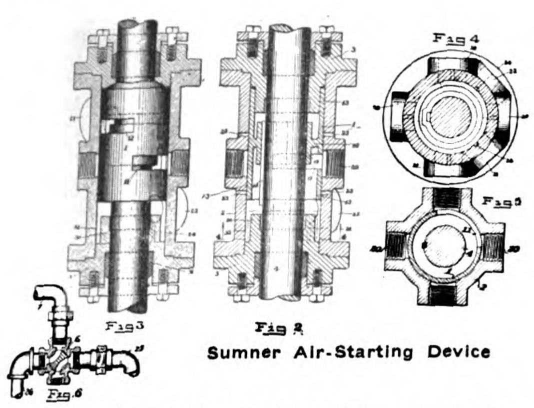
"Motorship" Illustrated Patent Record*

Selected Abstracts of Recent Published Patents of Internal Combustion Engines

Copies of original specifications may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

*Compiled and described by H. Schreck, Member American Society Mechanical Engineers

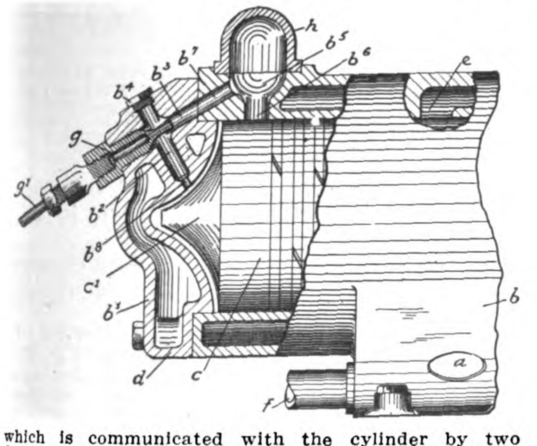
In the patent record of the September issue the "printer's devil" somewhat mixed up the arrangement of the various items. So, on page 23: 1,265,029. Starting Gear. J. W. Anderson, was intended to follow on page 24 next to patent 1,258,658, Diesel-engine type, of Messrs. G. C. Davison and J. W. Anderson, since these two patents are illustrated by the cut of the latter. With 264,994. Air Starting Device. H. W. Sumner, the accompanying cut of the distributing valve accidentally was omitted.



Sumner Air-Starting Device

1,261,466. IMPROVED COMBUSTION CHAMBER C. W. Weiss, of Brooklyn, N. Y.

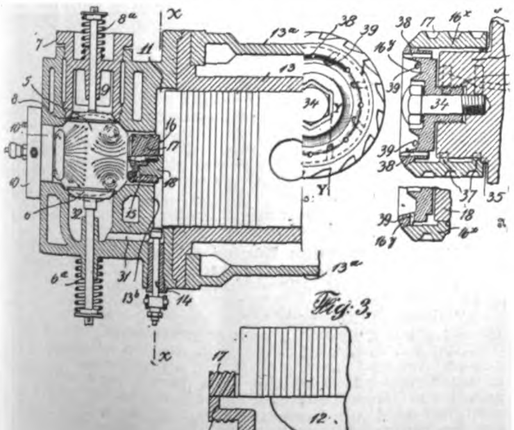
A two- or four-cycle internal combustion engine carries on its cylinder wall a combustion chamber b^3



which is communicated with the cylinder by two ducts b^2 and b^6. The latter is covered by the piston shortly before it reaches its forward dead centre, i. e., before the ignition of the fuel occurs. After the piston on its forward stroke has covered this port b^6 the compressed air is forced through b^8 and b^2 into the combustion chamber. This inrushing air, by passing over the oil nozzle g, has an injector action on the oil and carries with it an ample quantity of oil in form of a spray into the combustion chamber. The oil is ignited by the heat stored in the cap h which is unjacketed and uncooled and which is to be heated up when starting the engine. The air rushing through the narrow ducts back and forth will form an air envelop for the oil which will provide a thorough mixture of both and prevent also the deposition of carbon on the walls.

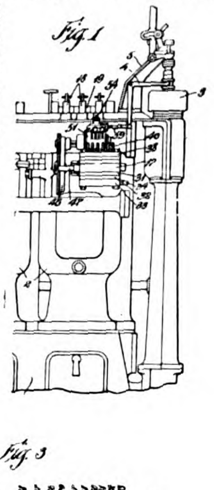
1,263,986. COMBUSTION CHAMBER ON INTERNAL COMBUSTION ENGINES L. Wygodsky, of The Baltimore Oil Engine Co., Baltimore, Md.

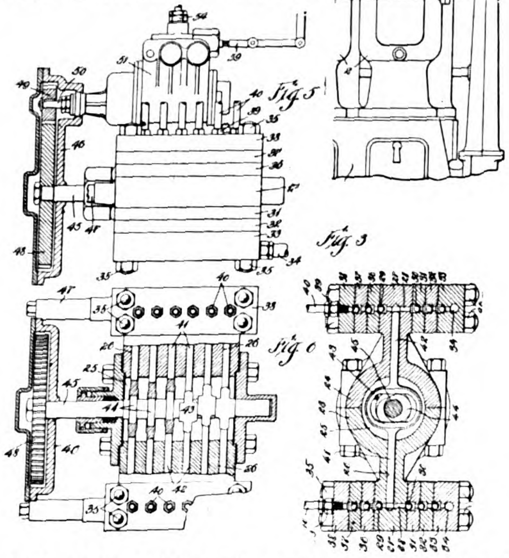
This invention relates to an improvement in the combustion chamber, in the methods of mixing air and fuel, and producing ignition, and facilitating the combustion on said engines. The combustion chamber is of substantially spherical form, and is connected with the cylinder through a neck of reduced diameter into which extends a projection of the piston at its inner dead centre. In this position the compressed air of the cylinder is forced through small passages and spiral grooves on said projection into the combustion chamber, producing a rotary swirling of the air and a very thorough mixture of fuel and air. The walls of the air grooves will become red hot and then act as a surface vaporizer and also ignite the fuel.



1,267,728. May 28, 1918. Fuel Pump of Variable Supply. A. Winton of Lakewood, O.

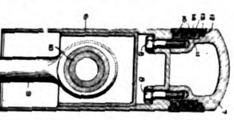
This invention relates to a fuel pump which is driven by an independent air motor whose speed is adjusted by the governor of the engine and is by its speed controlling the amount of fuel supplied to the engine in accordance with the load imposed on the engine. In the illustrations, Figs. 1 and 5, the air motor is marked "51," its speed is controlled by throttle valve "59." A set of gears "49"-"48" is transmitting the motion to the pump shaft "54" which in returns by means of eccentrics is driving the individual pump plungers "41" and "42" which are arranged in opposing directions. "34" are the suction lines of fuel and "40" are the individual discharge lines to the fuel injection valves.





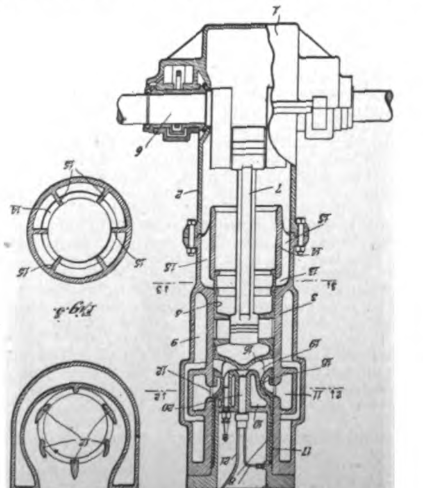
1,264,012. PISTON PACKING H. G. Chatain, of Erie, Pa.

This invention relates to a special design of packing rings and their follower rings. By this arrangement the rings have not to be sprung into place over the piston head and, therefore, can be made heavier as well as wider as they completely overlap the followers. The increase in width of the rings will be of advantage on cylinders with ports, and it will also improve on the heat transmission owing to the larger surface of contact with the cylinder wall.



1,265,857. May 14, 1918. Two-cycle Engine. L. Wygodsky of Baltimore, Md., Asignor to The Baltimore Oil Engine Co., of Baltimore, Md.

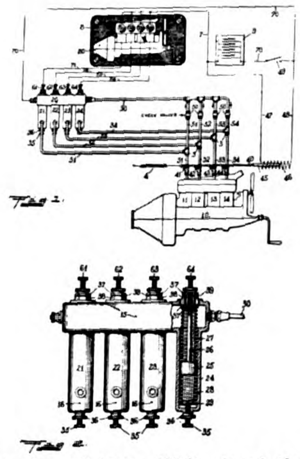
This invention, relating to an engine of the enclosed crank case type, has as its object to improve the scavenging of the cylinders. Such is obtained by a novel construction of cylinder, cylinder head, and piston. The



piston "5" is provided with a valve sleeve extension "17" which uncovers the exhaust ports "12" with the piston at its lower dead center. In this position the air from the crank chamber enters thro "13" and port passages "19" of the piston head and blows the burnt gases straight out of the cylinder. Another feature is that highly compressed air is obtained in the annular space of the piston sleeve "17" which may be used for the atomization of the oil.

1,266,627. May 21, 1918. Pressure Indicator. J. D. Renne of Omaha, Nebr.

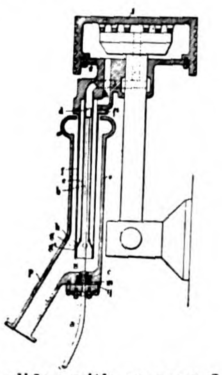
This invention relates to a mechanism which at any instant enables to check the compression of the cylinders, i. e., a tell-tale of which of the cylinders is at fault when the engine reduces in output. The



pressure indicating pistons "25," all of them, receive on the top side the highest pressure of any of the cylinders thro pipe line "30" whereas the spaces below these pistons are connected individually to each engine cylinder. Thus the difference of these two pressures will adjust the position of the indicator piston. With the cut an electric signal has been nicely arranged on a switchboard "8" which, if any one of the lamps would not be lighted any more, is instantly indicating which particular cylinder reduced in pressure.

1,269,454. June 11, 1918. Piston Cooling. O. E. Jorgensen of Copenhagen, Denmark.

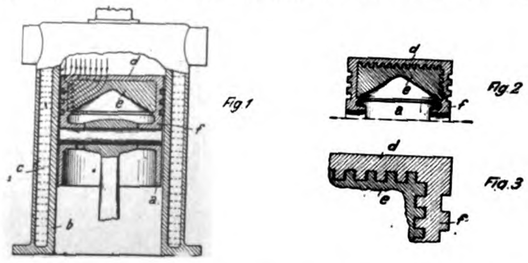
This invention represents a piston water-cooling device, with the inlet and discharge tubing arranged in one unit. The head piece "d" of the stationary



water supply "b" slides with an easy fit in the reciprocating pipe "e," and any water passing this sliding joint is flowing to the waste pipe without having reached the piston. The cooling water is pressed at a moderate pressure through port "i" to the piston and is leaving through port "k," down the annular space between "e" and "f," into the stationary waste pipe "o." No packing is employed; all parts can be made with considerable clearance, and any leakage of circulating water outside of the device is impossible.

1,270,663. June 25, 1918. Improvement in Air-Cooled Pistons. A. Riedler of Berlin, Germany.

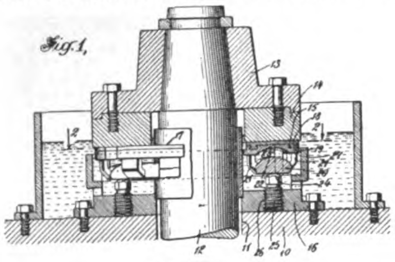
This invention refers to a device for increasing the heat transmission of an air-cooled piston. Beneath the underside of the bottom a heat conductor "e"

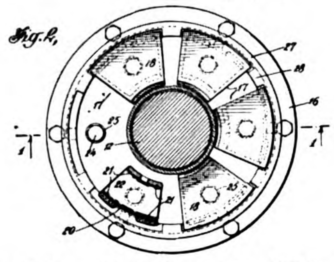


is provided, which will allow the heat, which is taken up by the bottom, to flow more readily into the wall of the cylinder. The cross section of this heat conductor increases from the central part toward the piston wall in proportion as the heat quantity to be carried off increases toward the peripheral portion of the piston.

1,270,622. June 25, 1918. Thrust Bearing. A. Kingsbury of Pittsburgh, Pa.

This invention relates to a construction of a thrust block, which novelty has aroused great interest with marine engineers. Secured to a revolving shaft is a thrust collar "13," which carries a thrust ring "14," with the annular bearing surface "15." The stationary part of the thrust block is mounted in the frame "16." A number of bearing shoes are tiltable mounted in this frame, and are supported upon the spherically curved



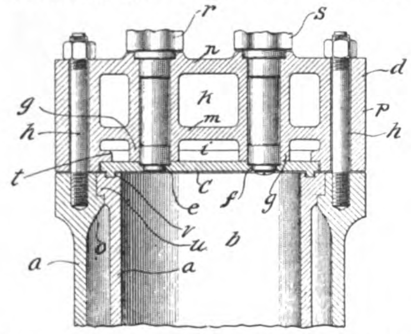


heads "24" of the adjustable screws "25." Each shoe "17," provided with a face of soft metal "18," is composed of a bearing member "19," a supporting member "20," and spacing lugs "21." The concavity of "19 increases the flexability of the shoe, the convexity of "20" makes it more rigid, and the spacing lugs, carrying the bearing member only near the edges, makes it relatively flexible and supports the wedging action of the lubricating fluid when entering between shoe and thrust collar. The shoe construction is light and therefore permits rapid temperature equalization.

(This invention is of particular interest because many of the motor-ships recently ordered by the United States Emergency Fleet Corporation will be fitted with it.—Editor.)

1,227,240. May 22, 1917. Cylinder Head Construction. A. Bie, of Winterthur, Switzerland, Assignor to Busch-Sulzer Bros.-Diesel Engine Co. of St. Louis, Missouri.

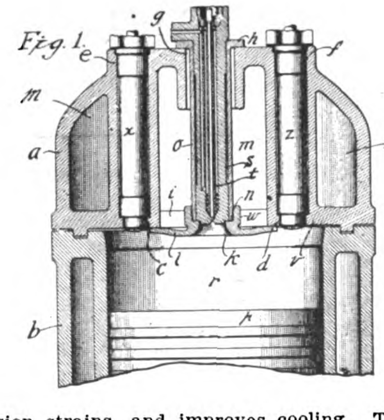
This invention relates to a construction of a cylinder head, which provides a separate plate "e" so as to render the cooling space accessible for cleaning and to



permit an easy replacement of that part of the head which is subjected directly to the heat strain. An inner transverse wall "m" may be provided so as to secure an exceptionally strong trussed construction. This design enables the head proper and this plate to be made of different materials with regard to their respective strains, to which they are subjected.

1,260,859. March 26, 1918. Cylinder Head Construction. A. Bie of Winterthur, Switzerland, Assignor to Busch-Sulzer Bros.-Diesel Engine Co. of St. Louis, Missouri.

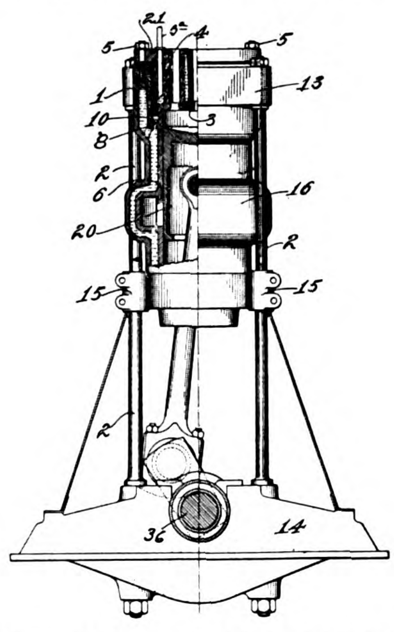
The object of this invention is to provide a construction of a cylinder head which affords access to the cooling space in the head, simplifies repair, reduces



expansion strains, and improves cooling. The flange "I," which closes up the opening of the head, is arranged after the manner of a manhole cover and is free to expand in either direction.

1,260,861. March 26, 1918. Cylinder Head Construction. A. Bie of Winterthur, Switzerland, Assignor to Busch-Sulzer Bros.-Diesel Engine Co. of St. Louis, Missouri.

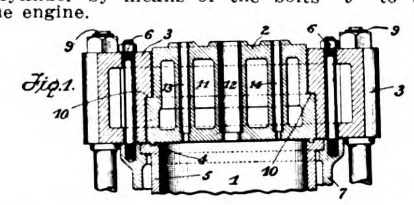
This invention relates to a special design which has as its object to take care of the thermal expansions and



contractions. At its upper end the head is provided with a flange which extends over the top of the water jacket and is secured to it by means of studs.

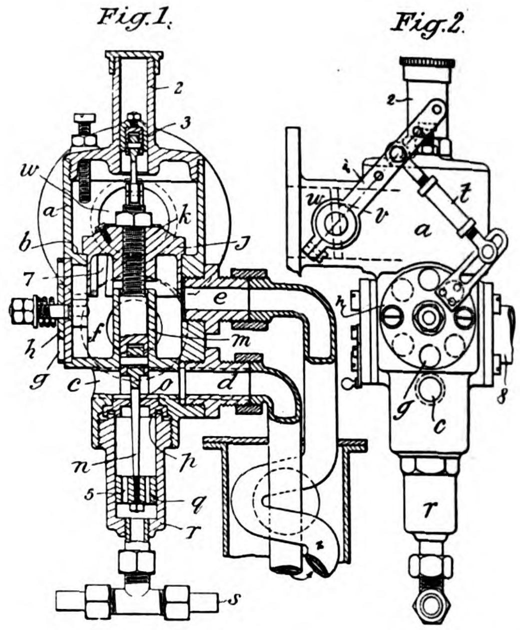
1,260,860. March 26, 1918. Cylinder Head Construction. A. Bie of Winterthur, Switzerland, Assignor to Busch-Sulzer Bros.-Diesel Engine Co. of St. Louis, Missouri.

This cylinder head comprises a central circular body "2," which is closing the end of the combustion chamber and an outer part "3," which is clamping the former to the cylinder and transmits the pressure of the cylinder by means of the bolts "9" to the base of the engine.



1,079,947. December 2, 1913. Carbureter. C. C. B. Morris of London, England.

This invention represents a carbureter, especially adapted for the use with fuel heavier than gasoline. The fuel, supplied from pipe "s," enters the cylinder "r," which serves at the same time as a dash pot, passes through perforations "5" and then through the orifice "o" past the tapered pin "n," by which the amount of fuel admitted into the carbureter is adjusted. Opening "c" is the main air inlet, to which a little blast may be connected. The carbureted air then enters through "d," a heating coil "z," and goes from there through "e" into the mixing chamber "f," where the auxiliary air is taken in through the holes "g" of the revolving disc valve "h," which is regulated with the throttle lever.



(This carbureter has been employed with great success on kerosine engines, and probably is the only one which actually gassifies the fuel, after gassification of which it is impossible to turn the gas back into a liquid. We have one of these carbureters in our office, which responsible persons can see if they desire.—Editor.)

1,136,818. April 20, 1915. Fuel Gassifier. H. F. Leissner of Ljusne, Sweden.

This invention relates to a fuel combustion arrangement, which divides the burning of the fuel into two distinct periods. Its ignition is effected by the temperature of the high-compressed air.

The fuel, which is introduced through the nozzle "e," immediately before the working stroke begins, is sprayed into the pre-combustion chamber "4," where a part of the fuel will be ignited by the compression temperature. The thus generated pressure will force the rest of the fuel partly into the compartment "5," and the larger part of it into the cylinder, where it will completely burn. As soon as the pressures of compartment "4" and of the cylinder have been equalized, the gases from "5" will flow into "4," and therefrom to the cylinder and carry with them all the residues of fuel, which will be then completely consumed in the cylinder.

This gassifier has been used in Sweden on engines of the smallest power up to 250 H.P. per cylinder, and resulted in an appreciable low-fuel consumption.

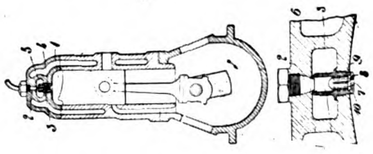


Fig. 1 Fig. 2

Reviews

Ten Months in a German Raider, by Capt. J. S. Cameron. Published by Geo. H. Doran Company, New York. As the title indicates, this is the story of the skipper of an American sailing-ship (that was sunk by the raider "Wolff") and his experiences aboard during ten months of the fifteen months' cruise of the "Wolff." This is an excellent book and well-worth reading, but unfortunately pressure on space prevents our giving a lengthy review.

Navy and Merchant Navy Signal Chart, published by the Army and Navy Signal Publishers, 8 Beacon Street, Boston, Mass. In these war days, when signalling often is of vital importance, a chart for signalling such as that illustrated on another page of this issue, will be found of great value, and all shipowners would do well to have numbers placed aboard every ship of their fleets, so that each sailor gets a copy. This chart is only 6¾" by 3⅜", so can be carried in the pocket. It is very concrete and comprehensive, and, together with the accompanying chartbook, describes all the systems under the various codes used in the navy and merchant marine. They are sold at $18.00 per hundred.

The Submarine in War and Peace, by Simon Lake. Published by J. B. Lippincott Company, Philadelphia, Pa. One of the most interesting naval books of the year is Mr. Lake's "Submarine in War and Peace," and this new work the non-technical man will find particularly absorbing, especially as the author is well-known as the inventor of the type of submarine now being built by the Lake Torpedo-Boat Company of Bridgeport. At the same time, Mr. Lake shows a singular lack of knowledge of the present submarine-type Diesel engine situation, as he takes great care to say that the successful engine of this type is not yet on the market. Considering the remarkable developments made during the war with the submarine-type of Diesel engine, this is rather a singular statement for Mr. Lake to make, and we would ask him if he has any authoritative data concerning the operating of the following engines built during the last three years, viz.: the Niseco, Schneider, Tosi, Ansaldo, Werkspoor, Sulzer, Vickers, and Normand. Everyone knows that the Diesel engines in the German U-boats have given reliable service, yet the engines mentioned by us are far more dependable; so, unless Mr. Lake can satisfactorily answer our question, his reputation as an authority on submarines surely must suffer. Unfortunately, no modern submarine illustrations appear in Mr. Lake's book, all boats illustrated having been built before the war, with the exception of the "Deutschland." All the same, Mr. Lake's book makes very excellent reading, and it could not have appeared at a more opportune time.

Practical Shipbuilding, by A. Campbell Holms. Published by Longmans, Green & Co., 4th Ave. and 30th st., New York. The revision recently made was extensive and thorough. Large portions were entirely re-written and the whole brought up to date by numerous additions, alterations and amendments. Three new chapters were added on longitudinal framing, damage repairs, and lifeboats and davits. A large amount of new matter was also added in connection with oil vessels, oil fuel, fire extinguishing, freeboard regulations, and bulkhead subdivision.

Steel Shipbuilder's Handbook, by C. W. Cook. Published by Longmans, Green & Co., New York. About 1,600 names are defined alphabetically and cross-referenced completely. The book contains four plates illustrating over 300 parts, and is designed to help workmen in the shipyards of the United States and Canada understand the terms used in steel shipbuilding. It is the result of a study of the latest and best methods of large shipbuilding plants all over the country. The pocket size makes easy reference possible to new names or words encountered while at work.

Internal Combustion Engine Manual, by Lieut. Commander F. W. Sterling. Published by Beresford of Washington, D. C. The Fourth Edition of this well-known treatise on internal-combustion-engines has lately been published after careful revision by the author. It is a book that deals principally with electric-ignition motors, but there is a section of considerable extent devoted to Diesel-type oil engines. Unfortunately this section of the book is not very up to date, as all the Diesel engines described are no longer constructed in their present form. Therefore, we hardly can recommend this part of the book to our readers except from a general information point of view, but the other section has its merits, which makes it useful to the student operating-engineer.